AIRLINE INSIGNIA ON BACK COVER

APRIL 25c

POPULAR AVIATION

SEE PAGE 258

PERCIVAL "MEW GULL"

TAYLOR CUB

Wingspan 50". Overall length 31". Will taxi and take off under own power and make long flights. This model is the only one endorsed by the Taylor Aircraft Corporation, manufacturers of the Taylor Cub Airplane.

THRILLS

From Sky and Sea

in these complete MEGOW KITS

$1.00 each

Postage 15 cents east and 20 cents west of Mississippi River.

Megow's new 1936 Kits bring you the most popular new models of boats or airplanes. Realistic and accurate in design, accurate in proportions and true in every detail. Look at the low prices for these big, complete kits—out of which you can build the finest models in your neighborhood. These are only a few random suggestions from our big new catalogue. Send for it today.

The "BOUNTY"

Exactly ¼ scale. Sailed for South Seas in 1787. Famed for historical mutiny in story and motion pictures.

These 24-inch Wingspread FLYING MODELS are typical of the Megow Line

25¢ each

Postage 10 cents east and 15 cents west of Mississippi River.

CONSOLIDATED P-30

Flying scale model of the Army's latest 200 M.P.H. attack plane.

MONOCOUPE

Dandy flying model of 90 H.P. Deluxe 90A.

Send 3c stamp for big new
ILLUSTRATED CATALOGI

MEGOW'S

MODEL AIRPLANE SHOP

Howard & Oxford Streets - - Philadelphia, Pa.

Chicago Office and Warehouse
627 West Lake St., Chicago, Ill.

DEALERS: Write for catalog, full information and discounts on this profit-building line.

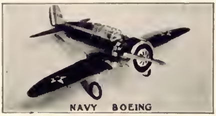
You'll marvel at the detail of these

50¢ SOLID MODELS

Postage 15 cents east and 20 cents west of Mississippi River.

WACO

Accurate in detail and realistic in appearance, these non-flying models provide endless instructive pleasure. Exact in scale, with elevators, rudders, ailerons, aluminum motor cowls, diecut wheels, etc.



NAVY BOEING

WACO BIPLANE

Wingspan 12⅞". Length 8¾". Cabin model, blue and yellow.

NAVY BOEING

Wingspan 10$\frac{1}{16}$". Length 7⅞". Yellow and silver.

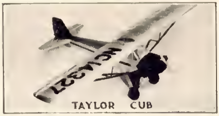
CURTISS HAWK

CURTISS HAWK

Wingspan 11$\frac{1}{2}$". Length 8¼". Army plane, yellow and olive.

TAYLOR CUB

Wingspan 12¾". Length 8". A small non-flying model of the flier shown above. Red and silver.



TAYLOR CUB

AVIATION TRAINING that gives you MORE than Aviation Training..

Practical aviation training, training which actually makes the student a part of aviation while in school, can be given only when an abundance of equipment is available. The completeness of its facilities accounts, in large part, for the leadership in the aviation training field enjoyed by Parks Air College for more than eight years.

In your training at Parks Air College for a career in commercial aviation you will secure a course which is at once *practical* and *comprehensive* in piloting, executive work, engineering, or maintenance, depending upon the field you elect to enter.

Practical, so that upon your graduation you can make the kind of connection you desire. *Comprehensive,* so that you can make satisfactory advancement.

But in your work at Parks Air College you will secure much more than aviation training. You will also win for yourself the same prestige which Parks Air College enjoys—prestige earned through more than eight years of constructive service in so training men that they are able to make worth while contributions to the development of commercial aviation—prestige earned by the splendid records made by these men with leading aeronautical concerns, such as:

Transcontinental and Western Air, Eastern Airlines, American Airlines, Pan American Airways, Pan American Grace, Douglas Aircraft Company, Lockheed Aircraft Corporation, Fairchild Aircraft Corporation, Consolidated Aircraft Corporation, Curtiss-Wright Airplane Company, and many others.

This prestige and appreciation is expressed by one major airline Operations Manager in this way:

> "It is impossible to overemphasize the importance of skill and dependability of personnel in airline operation.
>
> "Because of this fact and also because the certain growth of commercial aviation will require more well trained men than are now available, I want to tell you that I have a high appreciation of the work you are doing at Parks Air College. You can be sure that when we put on more men we will get in touch with you."

The General Superintendent of another major airline expressed similar appreciation this way:

> "Please be assured that we feel Parks Air College to be a source of excellent material for airline work and intend to continue to make use of your graduates in the future in various branches of our airline."

A leading aircraft manufacturer wrote:

> "We have found that any man recommended by Parks Air College is thoroughly and highly capable for the work they recommend, and always turn to them when we need additional men."

These expressions are similar to a great many more that could be quoted.

You, too, can enjoy the distinction accorded Parks Air College when you are able to say, "I have graduated from Parks."

This prestige will assist you, as it is now assisting hundreds of other graduates, in your progress in aviation.

For complete information about the opportunities offered you at Parks Air College, send for FREE Catalog. Fill in and mail coupon. It will bring the Catalog to you promptly.

The recognition and accredited standing given Parks Air College by the Superintendent of Public Instruction of the State of Illinois is indicative of its scholastic attainment in the field of higher education.

PARKS AIR COLLEGE
WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

SECTION 4 PA EAST ST. LOUIS, ILL.

Send me full information about Parks Air College, particularly concerning courses checked at the right.

Name____________________Age______
Address ____________________
City____________________State______

CHECK HERE
for special information on the course that interests you:

☐ Executive Transport Pilots'
☐ Aeronautical Engineering
☐ Master Mechanics' Flight
☐ Executive Course

YOU CAN COUNT ON AVIATION PRODUCTS

For Quality. Plus Economy.

OFFICIAL ARMY & NAVY HELMET

Made of brown chocolate leather. Chamois lined. Ear puffs neatly sewed in. Excellent construction.

PRICE Only....$3.25

• • • • • •

NEW STRAPLESS HELMET

Latest type of helmet. No Chin strap to chafe chin. Tight fitting. Special construction. Goggle straps. Rubber binding around outer edge holds this helmet snugly and makes it windproof.

PRICE Only $2.75

• • • • • •

WHITE GABARDINE HELMET

with pockets for ear puffs.

This helmet is going over big with plane passengers, sportsmen, autoists, motorcyclists, mechanics, etc.

Only ....98c (Special)

This Helmet with aviator type goggles, ear puffs and Log Book $2

• • • • • •

WHITE LEATHEROID HELMET

Excellent construction. This helmet popular with stunt flyers, jumpers, etc. Very distinctive.

PRICE Only $2.39

CHAMPAGNE SUEDE HELMET

Ear puffs neatly sewed in. A windproof helmet of light weight............$2.29

FOREST GREEN GABARDINE HELMET

Waterproofed. Ear puffs sewed in. This helmet is taped and sewed together. Can stand real wear and tear. A knockabout helmet.

PRICE Only $1.25
(SPECIAL)

REGULATION HELMET—Brown leather (unlined)

Built for hard wear. Snug fitting. Ear puffs sewed in. PRICE Only......$2.39

WHEN ORDERING HELMETS PLEASE MENTION TYPE OF HELMET AND HAT SIZE.

LATEST STYLE PARACHUTE SILK SCARF

Made of genuine white parachute silk, these scarfs are a handsome addition to any flier's wardrobe. Attractive for dress, as well as important part of equipment. Log book given free with each order. Wear a genuine parachute silk scarf this winter. Its' the latest style. Price only $1.98.

• • • • • •

AIRPLANE MOTOR MODEL CLOCK

This fine 6-inch model of a 9-cylinder aircraft engine fitted with reliable clock movement made of unbreakable metal with attractive chromium plated exhaust ring. Just the thing for your den, home or office. 30-day wind movement or electric movement. Price $3.95.

• • • • • •

PROPELLER CLOCK

Electric or wind movement encased in beautifully finished propeller measuring 27 inches. A real ornament for your office or den. Only $4.50.

• • • • • •

AIRPLANE TYPE AUTO COMPASS

Get this instrument for your car. It's the latest thing. Installed in one minute. Similar to Airplane compass being of the liquid type and having a rotating dial with jeweled pivot. A compensator is also given (not shown) to be placed under this instrument to offset magnetic effect of steel and electrical equipment in your car. Why take the wrong route? Know immediately whether your direction is right or wrong. Priceless on long trips. ORDER ONE TODAY. Price only $1.98 complete with full instructions.

GOGGLES

PROTECTOR GOGGLES. These goggles in good shape. Formerly $7.50. To close out PRICE Only............$2.98
(packed in aluminum cases.)

A-P PILOT GOGGLES WITH NAVY SPONGE RUBBER MASK. Non shatterable glass. Wide vision lenses.
PRICE Only $5.49

A-P PILOT GOGGLES with sponge rubber padding. Same as above.
PRICE $4.47

A-P FLYER GOGGLES. Non-shatterable lenses. Popular since 1917. War time flyers used this type goggle. Made to Govt. Specifications. Formerly $12.00
Now Only $3.50

A-P Special Goggle. Non-shatterable lenses. Strong sturdy construction. Single Strand Chenille face padding.
PRICE Only $2.25

BARGAIN GOGGLES. Good for motorcyclists, passengers, mechanics, etc. Ventilated good rubber cushions, removable lenses, extra wide vision frames. While they last, Only...........$1.59

NOTICE. A-P GOGGLES are equipped with non-shatterable lenses. Every pair guaranteed to last through every condition of tear, abuse and wear. A-P goggles are produced by the manufacturers of the famous RESISTAL goggle and are alike in every respect. Some flyers prefer A-P, others RESISTAL but the difference is very minute, if any.

COAST GUARD WIND BREAKER

A real jacket made of Jungle cloth especially for the aviator or any man who has to fight wind and storms. Made to Government specifications for the U. S. Coast Guard. Lined with plane fabric. Waterproofed. Zipper front. Big roomy pockets. A real jacket, fits snug. State size. RUSH ORDER. Price, $12.

QUALITY

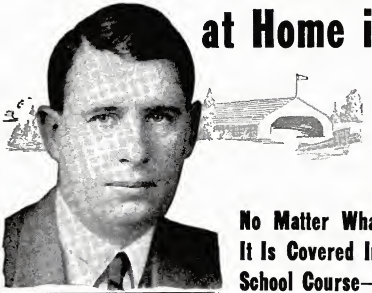
AVIATION PRODUCTS

CONFIDENCE

619 So. Federal St., Dept. PA-4, Chicago, Ill.

POPULAR AVIATION, Volume 18, April, 1936. Published monthly by Ziff-Davis Publishing Company, at 608 S. Dearborn St., Chicago, Ill. U.S.A. Subscription $2.50 per year, single copies 25 cents, foreign postage $1.00 per year extra, except Canada. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879.

Study Aviation from the Ground Up at Home in Your Spare Time



with

WALTER HINTON

WALTER HINTON, President of the Aviation Institute of America is one of Aviation's trail blazers, pioneers, explorers, instructors, authors. He was the first man to pilot a plane across the Atlantic (the famous NC-4)—the first man to fly from North to South America—one of the U. S. Navy's crack flying instructors during the War—teacher of many successful men in Aviation today. Get Walter Hinton's Big Free Book. Mail the coupon today.

No Matter What Branch of Aviation Interests You It Is Covered In This Complete Home Study Ground School Course—Free Trial Enrollment Protects You

Read These Letters From Hinton Trained Men

Course Helped Pass Government Examination

"I am a holder of an aeroplane and engine mechanic's license and a private pilot's license. Your Course helped me a great deal to pass the examinations." JOHN HALENDA, 329 S. Balliet St., Frackville, Pa.

Course Makes Flight Training Easy

"I bought a ship this summer and I have 8½ hours dual already. The instructor says I'm just about ready to 'solo.' Your course is making everything easy for me. I'll recommend it to anyone. PAUL GLINZAK, Box 124, Smithfield, Ohio.

Course Foundation For Advanced Training

"I recently soloed at the local airport and now have some solo time. I am going to California to study Aeronautical Engineering. I certainly appreciate your obtaining the reduction in tuition cost for me. MILTON D. HUNNEX, 501 Balm Street, Walla Walla, Washington.

Accepted For Royal Canadian Air Force

"I sent your letter with an application for enlistment in the Royal Canadian Air Force and I received a letter stating that my application is accepted and I can enlist as soon as there is a vacancy." JOSEPH J. BEISIG, Melville, Sask., Canada.

Received Prompt Answers To Questions

"When I was puzzled over any particular part of a lesson, I found by dropping you a line I received a prompt and willing reply. I'm another booster for the Aviation Institute." GRANT BATES, Murtaugh, Idaho.

AVIATION is today's great, growing industry. Probably no other field offers such great opportunities and such a brilliant future for young ambitious men. But, unfortunately, Aviation requires more than ambition and youth. Aviation requires **training**!

To get this training, it is no longer necessary for you to give up your job and spend $500 to $1,000 to study Aviation as many men had to in the past. For you can start training for Aviation right in your own home—in your own spare time—at only a small fraction of this cost. Yes—you can start today to get the training every man in Aviation must have—no matter what branch of Aviation he enters.

Aviation Is Big, It's Growing Fast, Train Now

In 1935, passenger traffic on accredited airlines broke all previous records. On July 1st, 1935, U. S. Government reports showed that there were 2,343 airports in the country. American Airlines fly a distance equal to 1,700 times around the world every year carrying an average of 7,500 passengers, as well as tons of mail and freight every day! Trans-Pacific Air Service has been formally opened and successful flights have been made. 160,013,192 passenger miles were traveled by American Airlines during the first half of 1935. The first all-expense air tours were introduced. And remember—these new developments **all** took place in 1935—last year.

One large airline now employs 400 men to service their transport planes in one large super-service depot alone! One of the largest airlines in the country employs 62 men on the ground for every plane in the sky! Aviation is big. Aviation offers far more than just an opportunity to fly. It offers ambitious men many opportunities in many different branches—not just a few here and there. Aviation is a field worth training for!

Train At Home In Spare Time

Walter Hinton's eighteen years of experience—including five years training men for the Naval Air Corps—stands behind this Course. Every word in the Lesson Texts is so clear that practically everyone can understand it. Walter Hinton's own reputation in Aviation is your definite assurance that you will receive the most modern, the most practical, the most thorough home study training possible.

A Few of the Subjects Covered In This Course

●

- AVIATION TERMS
- PRINCIPLES OF FLIGHT
- CONSTRUCTION MATERIALS
- AIRPLANE CONSTRUCTION
- AIRPLANE RIGGING
- AIRPLANE DIESEL ENGINES
- AIRPLANE CONTROLS
- PLANE INSPECTION
- PLANE AND MOTOR INSTRUMENTS
- IGNITION
- AIRCRAFT ENGINES
- MOTOR INSPECTION
- CARBURETORS
- PROPELLERS
- AEROSTATICS
- AIRPORT MANAGEMENT
- AERIAL PHOTOGRAPHY
- AIR NAVIGATION
- AIRCRAFT RADIO
- AND MANY SUBJECTS

Free Trial Enrollment Plan Protects You

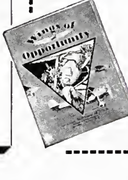
You can enroll with the Aviation Institute—can actually start training for Aviation—without risking a single penny. For 30 days you can receive all the benefits any regular student receives. During that time you decide whether or not you wish to continue—and if you decide not to go ahead—the trial does not cost you a cent. You can find what the Aviation Institute has to offer you—without any risk whatsoever. And in addition—when you complete the entire course—you can receive your money back if you are not satisfied in every way. You take no risk. You are doubly protected. MAIL THE COUPON for details of this new Trial Enrollment Plan—and Walter Hinton's Big Free Book on Aviation.

Big Book On Aviation Sent Free

If you are interested in Aviation—now is the time to ACT! Now is the time to find out what Walter Hinton offers you—about how he can train you at home in spare time for Aviation—and about what other students and graduates think of Hinton training. Mail the Coupon NOW—in an envelope or paste it on a penny postcard.

Walter Hinton, President Aviation Institute of America, Inc. 1115 Connecticut Avenue, Washington, D. C.

Mail Now for Facts



Walter Hinton, President 936-S
Aviation Institute of America, Inc.
1115 Connecticut Avenue, Washington, D. C.

Please send me a Free copy of your book, "Wings of Opportunity," and the details of your Free Trial Enrollment Plan. I want to know more about my opportunities in Commercial Aviation, and your tested method of home training. This request does not obligate me. (Print clearly.)

Name ....

Address .... Age ......

City .... State ....

This One
EBG6-K8Z-BPB9

Coming Features in the MAY Issue

ALL fans remember the old Aeronca pictured above. Well, there is now a new Aeronca, so radically different from the old model that you would never guess its name. It will be featured on the cover, and in colors, in the May issue of POPULAR AVIATION.

POPULAR AVIATION for May presents many new features in addition to those departments that have proved so popular in the past. This issue will cover all the up-to-the-minute developments that are of importance to the world of aviation.

Lightplanes and gas models will once more be in the spotlight. Rapid progress is being made with both of these interesting aeronautic subjects and 'ole P. A. will give you all the dope on what is being done in U. S. A. and abroad with the baby planes.

For the casual reader, T-2003 will tell of new developments in the Army Air Corps in regard to reconnaisance, spotting and attack aviation. And his stuff is authoritative. And then, we have a fine story about the life of Al Williams which will be intensely interesting to followers of air-races and air-shows. And speaking of air-shows, we'll print a new story on the Gates Circus and the personal exploits of the author while a member of the circus.

And there will be a wealth of material in the old departments, What Our Readers Are Building, the model department, engine maintenance and similar subjects. And—last but not least—there will be more airline insignia on the back cover, including the leading European airlines, and also a beautiful colored map showing the airlines of the United States.

POPULAR AVIATION,
608 S. Dearborn St.,
Chicago, Ill.

Gentlemen: Enclosed find $2.50 for which please send me POPULAR AVIATION for one year, starting with the May Issue.

NAME..

ADDRESS..

CITY...STATE...........................

USE THE COUPON

GENERAL Headquarters—for Aviation—is found at San Diego. Ryan School of Aeronautics is located at the scene of the most intensive and widest variety of aeronautical activity to be found anywhere in America. Students are in close contact with these important activities:

1. The U.S. Navy's largest flying base, North Island, directly across San Diego-Bay, operates continually over 400 planes of every variety.

2. Government aircraft and engine repair shops—largest and finest in existence.

3. The most active aircraft manufacturing area in the world. The factory of the Ryan Aeronautical Company, with which the Ryan School is affiliated, is directly adjacent; and only 100 feet north of the school on Lindbergh Field is the huge new factory of the Consolidated Aircraft Corporation, with over 240,000 feet of floor space; while within a 100-mile radius are located the factories of Douglas, Lockheed, Northrop, Vultee, North American Aviation, Kinner, Solar, Security, and Menasco. A demand by these and other concerns for Ryan graduates greatly exceeds the supply. Why? Because Ryan trained men have proven they are qualified to "fill the bill."

4. Year 'round flying weather. No one appreciates so well as the experienced pilot the advantages to the flight student of maintaining an uninterrupted training schedule. The government flying base was originally established in San Diego on account of its ideal conditions for aviation. This also accounts for Southern California's predominance in aircraft manufacturing activity. Its delightful, semi-tropical weather has brought international acclaim.

A SINCERE COMPLIMENT

The placement department of Ryan has a long list of requests from aeronautical concerns for recommended graduates, which is continually exceeding the number it is able to supply. Ryan training will prepare YOU for one of the many opportunities open for you in aviation!

Right now is the ideal time to start!

5. The Most Important Reason—the superiority of Ryan training. The Ryan School is the oldest aeronautical school under original management; fourteen years of training men for this industry—there is a reason for this record of consistent success. An impelling spirit of progress is the permeating spirit of the Ryan School. Ryan training above all else is sound, thorough, and modern. To make this possible, Ryan has a staff of instructors, every one of whom is outstandingly well qualified in experience and ability. Buildings, classrooms, shops, equipment, and facilities of all kinds are of the finest and meet the needs of modern training for this industry

Ryan School is known as "America's Most Modern School of Aviation" and Ryan sees to it that this lead is maintained. Still more new buildings, new equipment and facilities have just been added.

Ryan IS the G. H. Q. You will choose most wisely if you select the school that will give you the best training, the most complete foundation and whose graduates have the greatest opportunity of realizing their full ambition in aviation.

Get the complete story on Ryan today. Check the course you are most interested in and full information will come to you immediately.

RYAN SCHOOL OF AERONAUTICS, Dept.
Lindbergh Field, San Diego, California PA-4

I am interested in courses checked: Please send additional information.

- ☐ Transport . . $1975
- ☐ Limited Commercial . . . 585
- ☐ Private . . . 585
- ☐ Amateur . . 295
- ☐ Master Mechanics $550
- ☐ Weems Navigation 150
- ☐ Aircraft Welding . 100
- ☐ Aircraft Radio . . 35

Ryan deluxe Combination Course Transport training plus new Ryan S-T high performance plane 4642

Name____________________ Age_____

Address__________________________

RYAN SCHOOL OF AERONAUTICS

An Airy Chat With the Editor

HOW many of our readers remember the old Aerial Experiment Association, founded by Alexander Graham Bell, the school in which so many vital facts were discovered?

Glenn Curtiss was a prominent member of this association and, later, continued the work started by the A.E.A. Their first flights were not far behind those of the Wright Brothers and were very successful. We have a very interesting story about these early days, by one of our Canadian contributors, which we trust will enlighten many of our readers on these very earliest pioneering activities in aviation.

* * *

LANDING-GEAR accidents continue to contribute an increasingly large percentage of airplane accidents. It is right here, in the design of substantial landing-gears, that we can best serve modern aviation.

Of course, as may be expected, our aerodynamical experts were the first to enter the arena in the solution of the problem. Their contributions were wing-slots and flaps by which the landing and take-off speeds could be reduced and this, of course, hits the trouble right in the eye by reducing the primary cause of landing-gear failure.

Better wheels, better tires, better shock-absorbers, and all of them more substantial, is the demand of modern aviation. This is not true alone of commercial transport planes but also of privately owned craft in which the owner very frequently swipes off the legs of his valiant ship. Strange to say, there are comparatively few amateur builders who have experienced this trouble.

* * *

JUST as in any industry, the aeronautical industry has a high business mortality that is due more to lack of commercial experience than to knowledge of airplane design and construction. Hundreds of small aviation companies have started out with a roar only to fall dismally by the wayside within a comparatively short time.

We can put the cause of these failures into two groups: (1) Pilots or technical men placed in charge who know aviation from "A" to "Z", but who have had little or no business experience. Group No. 2 consists of business men who burst into aviation on a "hunch," with no knowledge of the field and really commit more and greater errors in merchandising than even the pilots and technical men.

Not more than one percent of these amateur executives know how to contact their public through advertising or direct sales. Another two per cent fail because they do not understand the habits and customs of people who are prospects for planes. Another two per cent have the mistaken idea that they are in a deluxe market, catering only to the wealthy, while in fact, there are not many wealthy people that take any interest in the sport —at least not enough to help the industry. These are the sort of men who build 750 h.p. air-sedans that frolic along at more than 200 m.p.h., and they then wonder why they have no sales!

They all overlook the fact that their greatest opportunity lies among middle-aged men of the great middle-class who are notoriously good spenders on anything that strikes their fancy, just so long as it comes within their pocketbook zone. The game is not helped in the least by either the ultra-wealthy nor the penniless kids. Go out and solicit business where business is good!

* * *

IT'S EARLY in the season, but already the rumors of super-speed racers are being spread around. It was this way last year, year before last, and so on, but nothing materialized in the way of excess m.p.h. The last whisper reaching our ear concerned a winged engine that was clocked at 365 m.p.h. It sounds to me as if our correspondent got his m.p.h. tangled up and confused with the number of days in the year, his telephone number—or something. When they do a burst of 365 m.p.h. at the Nationals, I'll be in such a condition that I will not hear—nor care—about it.

* * *

ANOTHER man has just discovered the principles of the helicopter! ! ! He wrote all about it in a 96-page letter (not much of an exaggeration), and he really believes that he is the first bimbo to lift himself up by a rotating screw. If he goes on with his project, he is due for a lot of disagreeable discoveries and a wrecked wallet.

* * *

ABOUT a dozen people have written in, protesting against our articles on the Flying Flea. According to their ideas, the Flea is no good, can't fly, is dangerous, is a bunch of junk and so on. Well, I only wish that we were as successful as they have been in finding out the truth about the Flea. We get oceans of letters on the subject from everywhere on earth but even so, nobody seems to agree on anything, more than momentarily, and the ones who are the most undecided and uncertain are the ones who have actually built and flown the Flea. The only correspondents who are sure of their ground and are dead positive of their convictions, are invariably the ones who never actually saw a Flea.

* * *

BUT there is one thing that we are very much interested in and that is manually propelled flight or "self-flight" as one might say. In France quite a lot of work has been done with man-powered "avionettes" and some of them have sailed over a distance of a few meters, but in the United States, the amount of research and experiments has been very limited.

If man is to fly by his own exertion, then we must have a very efficient device for converting his muscular effort into available flying power. At the best, with his tongue hanging out and the perspiration rolling down his noble brow, he can only develop one-eighth horsepower for a few seconds. When he moderately pedals a bicycle, on a pleasure jaunt, his power output is in the neighborhood of 0.01 horsepower; hence we are still more limited if we wish to make manual flying a pleasure instead of arduous labor.

And we cannot expect very much from 0.01 horsepower in the way of performance. The great trouble lies in the fact that man is too heavy for his horsepower rating. Thus, if he weighs 150 pounds and can develop only 0.01 horsepower, he is loaded down to the tune of 15,000 pounds per horsepower which is a very considerable power-loading. In short, he is loaded just about 1,000 times heavier than the average airplane which is loaded close to 15 pounds per horsepower.

But, we still think that something might be done about it. Some time it will be accomplished and we would like to push that time up to date as much as possible. If there are any of our readers who have a contraption of this sort stowed away in the hay-mow, basement or woodshed, write in and tell us. Mebbe we can make it interesting for you and the rest of the bunch. If you can flap your wings over a distance of 100 feet at an altitude of two feet, you've

(Concluded on page 292)

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE
FOR THE
PROMOTION OF
AMATEUR
AVIATION
AND
PRIVATE FLYING

Volume XVIII APRIL, 1936 Number 4

TABLE OF CONTENTS

FEATURE ARTICLES

An Airy Chat With the Editor.....236
Blazing the Northwest Passage With a Lockheed Electra.....238
Breaking the Ice for Aviation.....241
Flying in Switzerland.....243
Diplomats of the Airways.....245
Lyman Gilmore, Jr.—Pioneer.....247
She Will Wing Over China.....249
Laying Out a Propeller.....251
The Gliding and Soaring World.....253
High-Lights and Side-Lights.....255
About Eddie Rickenbacker.....257
Stress-Analysis Made Painless.....259
Lubrication and Your Engine.....261
Maintenance of Parachutes.....263
Painting and Doping Your Ship.....265
Letters From Our Readers.....267
What Our Readers Are Building.....271
How Airspeed Meters Work.....273
Building the Mew Gull Model.....275

PICK OF THE BRIEFS

Europe's Famous Woman Pilot. Maryse Hilsz.....244
Is the Christie Flying Tank Practicable?.....250
Aviation Book Reviews.....250
Britain's Flying King.....248
Why College Men Take to Aviation.....252
Milburn Type MM Paint Spray Gun.....262
Wingless Model Plane Flies.....262
The Radically Different Caldwell Ship.....264
"Saved by Airship"—An Old Thriller.....264
The Fairchild Type 91 Amphibian.....268
Try These When You Are Blue.....268

Copyright, 1936
Aeronautical Publications, Inc.

POPULAR AVIATION, Volume 18. Number 4. April, 1936. Published monthly by Ziff-Davis Publishing Company, at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor. New York Office, 381 Fourth Ave., New York City. Subscription $2.50 per year, single copies, 25 cents; foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Photos and drawings will be considered as constituting a part of the manuscript in making payment unless otherwise specified. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879.

Blazing the Northwest Passage

by

MAX KARANT

Associate Editor of POPULAR AVIATION

Ready for the take-off, with the passengers aboard and the pilot gunning the engine, this Lockheed Electra is starting on its long grind along the route of the Northwest Airways.

IN the early morning air (it's 7 a.m.) 850 horses cough, bark and burst into an ear-splitting bellow . . . the wide runways of Chicago's municipal airport cling to the spinning wheels of the sleek silver twin-engined Lockheed Electra . . . rapidly, however, the westbound airliner leaves the swirling dust of the airline terminal behind . . . airport visitors see the plane's sturdy landing-gear creep up into its belly.

To the casual watcher, this scene probably implies something that he or she always has wanted to do . . . to climb into a lightning-fast luxurious transport airliner and fly to distant places. To the airline pilot, however, Trip 1 was merely taken off for its daily run to Seattle . . . there are no mysterious delusions as to what's in store for him, his airplane and his ten passengers up ahead. He knows more about the weather and condition of the various airports along his division than do the majority of that territory's natives themselves . . . he'll know of the slightest change in ceiling, temperature, barometric pressure and visibility instantly.

Flying between Chicago and Seattle by way of the Twin Cities, Fargo, Billings and Spokane, unquestionably is the most fascinating scenic flight to be found anywhere on the North American continent. Plains, prairies, bad lands, lakes and tremendous awe-inspiring mountains all are included in the price of the airline ticket . . . breath-taking adventure that can hardly be called adventure in the strictest sense of the word . . . for to have real adventure one must have unknown dangers lying ahead . . . and the almost boring matter-of-factness and safety that lies along an airline's path today is an established fact.

Back to the west bound airliner. The pilot, this trip, happens to be Mal Freeburg, one of the outstanding transport flyers in commercial aviation today . . . but he isn't the only "ace" on the line. There's Mel Fried, Bob Mensing, Jerry Sparboe, Nick Mamer, "Cash" Chamberlain, Joe Orbeck—one can go on and on . . . each has flown the equivalent of scores of round-the-world flights.

"Freeburg to Chicago. Go ahead."

"Chicago to 60. Go ahead, Mal."

"Ninety miles out of Chicago. Two miles northwest of Rockford. CAVU. Go ahead."

"Okay, Mal."

Short, terse conversations like this inform the airline's ground stations of their plane's position. Identical "sequences," as they're called by the pilots, are kept by every flying airliner each half hour.

Lounging in a softly cushioned easy-chair makes it hard for the airliner's passengers to realize they are traveling 200 miles an hour. The small farming towns of northern Illinois and southern Wisconsin drift lazily under the broad silver wings. The weather is clear and cold . . . thermometer reads two-degrees above zero outside . . . cabin temperature is 76 . . . comfortable business men and women pay more heed to their books and magazines than to the 10-mile airway beacons or passing towns.

A slight smoky haze marks Madison, Wisconsin's state capital, off to the right over rolling hills, crossing the icy Wisconsin river. Our co-pilot, Art Haid, comes back into the cabin. He has completed his half-hourly sequence with the St. Paul radio station. On this airline, co-pilots take the place of stewardesses used by other companies. Many seasoned air travelers prefer the efficient young pilots to the flying ladies.

Although the passenger doesn't realize it, Freeburg has been climbing steadily to 8,000 feet to take advantage of a 40-mile tail wind reported at that altitude by the airline radio observer

The peak of Mount Rainier stands out brilliantly above the black shadows of the lowlands.

With a Lockheed ELECTRA

Flying low over the hills and valleys of the western country, and outlined against the clouds, this Lockheed Electra of the Northwest Airways makes an inspiring and beautiful picture.

at La Crosse, Wisconsin. There's no need to ride the beam this morning . . . visibility is good enough for visual or contact flying. In bad weather, however, the automatic radio beam is an invisible aerial highway as cut and dried as the steel railroad tracks below.

Skirting along the left bank of the Mississippi river Freeburg reports the on-time passing of Winona, Minnesota . . . another hour of easy flight and there comes the low hum of lowering landing gear. A flashing light requests passengers to fasten safety-belts, another high-pitched whine marks the operation of the speed-arresting wing flaps and, with a gentle rumble, the heavy airliner settles to the surface of the Minneapolis airport. The tail winds have made the trip 20 minutes ahead of schedule.

Taking on gas and a new crew after the short two-hour trip, the loaded Electra climbs rapidly away into the western sky. The pilot now is Carl Leuthi, diminutive veteran of the airline's Twin Cities-Billings division. The co-pilot is Lee Wright. Their division is the longest one-crew airline trip in the United States.

Thousands of Minnesota's famed lakes now appear on the scenic menu as the plane climbs higher into the cold morning air, more and more historically famous sites and towns appear on the horizon. Sauk Center, made famous by Sinclair Lewis, the novelist . . . Andrew Carnegie's hunting grounds, Osakis . . . Alexandria, Fergus Falls . . . off to the left a string of airway beacons mark the route the pilots follow by night . . . less than two hours of idle sight-seeing and the hum of lowering landing gear tells of the approach to Fargo, North Dakota.

Fargo is the airline's division point between the Chicago-Seattle route and the Canadian branch to Winnipeg. Mail and gas are loaded aboard, and passengers for Winnipeg are transferred to the waiting airliner.

Leuthi and Wright have verified the weather conditions ahead. Bismarck reports a 12,000 foot ceiling and unlimited visibility. Miles City has slight snow flurries but good visibility. Billings is reporting good flying weather.

Following railroad and highway out of Fargo, Leuthi and Wright do their usual chores with manifest charts and weather reports. Passengers strike up conversations about the various interesting scenes near Valley City and Jamestown. Conversations go on as easily as in a quiet office building. Modern insulation research by the Lockheed company has made this transport the quietest airliner of the day. A Bureau of Air Commerce weather report from the Jamestown station reports good flying down the line.

Shortly, the Missouri river appears on the horizon and, alongside the river, stands the Bismarck airport. A few brief moments at the North Dakota capitol is spent in loading air mail. In five minutes the Lockheed is speeding down the runway toward the next stop, Miles City.

The first of the North Dakota bad lands appear. Rough, wild country, the bad lands are a hypnotic sight when flying over them in the bright moonlight that typifies the Pacific Northwest . . . petrified trees are easily seen when flying over the bad lands by day . . . near here General Custer and Buffalo Bill roamed.

The string of beacons off the right wing have the Kill Deer Mountains as their background. These beacons serve the airliner's Glendive division to the north as well as the through non-stop run to Miles City. Nestling down in a valley between those high buttes lies Medora. As this tiny cow town passes to the right of the airliner, Lee Wright tells of the days when Tom Mix and Teddy Roosevelt "hung out" there.

The faint clicking of the airliner's short-wave transmitter marks the half-hourly conversation between Leuthi and the Miles City operator. The set is installed under the front right-hand seat in the cabin and the click of the switch and faint glow of transmitter tubes

Not far from the airway is this memorial to Buffalo Bill, noted Indian scout and premier American showman.

mark each sequence kept by the pilot.

Approaching the Miles City airport the Yellowstone river is seen curving out of the north. The airline meets and crosses this historic stream at Miles City . . . the airport is just across the river. Another short stop, a mail pick-up and Leuthi is again lifting his loaded sky liner into the afternoon skies . . . skirting the Yellowstone over some of the most famous cattle, cowboy and rustler country in the United States.

The airliner soars high over the Powder river section, noted for its rip-snorting hard-living pioneers . . . crossing high foothills and passing the Bull and Rosebud Mountains to the left, Billings appears suddenly in a deep valley, "down gear", flaps are lowered and Leuthi nurses his ship in to a fast landing on the Billings terminal which is high on a plateau overlooking the city below . . . planes taking off from this field to the south merely have to fly straight off the edge of the airport to gain 500 feet altitude.

There's an interval at Billings for the changing of planes and crew. Passengers lunch on some real cow country grub as guests of the airline. While around them are the rolling Montana hills and mountains in which lie America's heart of the dude-ranching industry. Millionaires and clerks alike travel to this country annually where they rough it on any one of dozens of secluded cattle ranches.

Technically speaking, Billings has an airway radio feature addition novel to most airlines. A "monitor station" has been erected at the airline's terminal by which each radio station on the entire airline system can be checked as to wavelength accuracy.

After a 30-minute rest the passengers once again climb aboard to be greeted by Jack Bain and Len Ashwell, two veterans on the Billings-Spokane division. The remainder of the northern transcontinental flight to Seattle, over the wild Lewis and Clarke country, is the most scenic to be found on an airline system anywhere in the United States. Ahead lie Butte and Helena, Missoula and Spokane while the expectant passengers spend more and more time looking out of windows and asking questions.

Another beauty spot taken along the route of Northwest Airways. Snow covered peaks greet the eye from the vantage point of the plane.

Len Ashwell probably is one of the best-informed pilots on his division. He can describe in detail any historic and interesting point anywhere along the entire division to Spokane . . . consequently, he's in the cabin most of the trip feeding the insatiable curiosity of the air travelers.

All flying now is made up of almost constant climbing . . . there to the left is the north entrance to Yellowstone Park . . . also the Bear Tooth and Absoroka Mountains, . . to the right are the towering Crazy Mountains while ahead and above the nose of the climbing airliner is the Bridger range. . . Bozeman, Montana, passes to the left and Jack Bain steers his ship for the deep pass through the Bridgers . . . forests pass outside level with the cabin windows . . . the hardest passenger is drinking in every detail of the country . . . wild game stare curiously at the passing silver monster roaring with the speed of light through wide canyons . . . Ashwell points out a working gold-mining dredge in a valley below.

Trip 1 is scheduled to stop at Butte instead of Helena. Each day's schedules alternate between these two famed mining centers of Montana . . . breathtaking and fascinating as the flight to Butte may seem, it is just a small sample of what lies in store ahead . . . the airliner slips into a high-altitude airport at Butte, is quickly refueled, mail is transferred and the long climb to Missoula starts.

Airway beacons now appear at five-mile intervals, curving "lazily" through the mountain passes. Jack Bain reports the passing of the emergency airport at Drummond. . . . The airliner soars over the trunk railroad and highway in that section . . . mountains and rivers pass in snow-covered majesty . . . more and more snow is found as the higher altitudes are approached . . . most mountain peaks are completely snow-covered although many towns in valley floors have green grass.

The altimeter reads 7,000 feet in the passes. The ever-present radio beam is a godsend in this country and with their equipment, it's as easy for airline pilots to fly blind in this territory as it is to do normal visual flying. Airline pilots flying this section are probably the best trained regular blind-flying pilots in the United States if not the world for much of their work entails constant instrument flying and their equipment, so far as that which is operated by the airline itself is concerned, is the best money can buy. There's one section of the Spokane-Seattle division, over the rearing Cascade Mountains, that pilots have flown daily but haven't seen for more than a month.

Turning a bend in the pass, the Missoula airport appears suddenly under

An interesting view of Spokane, Wash., viewed from one of the many hill-tops that surround this city.

the plane's engines . . . down gear, fasten belts and the routine mail loading and refueling procedure again takes place. Pilots Bain and Ashwell grin good-naturedly as their passengers stretch legs on the airport. "How do you like it? Have you any suggestions you'd care to offer?" Friendly questions greet the air traveler anywhere on the line, from pilots to dispatchers, it's all the same. "All abo-o-o-ard." The dispatcher's voice rings out on the still mountain air and the passengers climb in for the next hop to Spokane.

Following the passes through the beautiful Bitter Root Mountains, the click of the radio transmitter casts an eerie, realistic light on what appears to be a series of communions with ethereal beings. Ashwell comes back into the cabin as soon as his radio and chart work is completed . . . enthusiastically, he describes the country over which the ship roars.

In the Bitter Roots, curving up from the south and crossing the airliner's path just ahead, lies the Idaho-Montana border. Climbing steadily, Jack Bain checks off the beacons at Superior and St. Regis, records his altitude, speed, weather and ceiling. Just ahead lies the entrance to the wild Idaho panhandle, Mullan Pass.

Ashwell tells of the fascination his division affords its pilots. Despite the years they have been flying their run between Billings and Spokane the pilots all look forward to the trip. Indescribable beauty that would only cause descriptive words to appear hackneyed and trite is the lot of these airmen who fly daily over this vast, silent country.

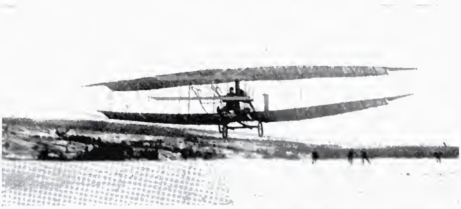
Jack Bain levels off as the Lockheed tops the highest peaks in the Coeur d'Alene range . . . swiftly the ship sails into Idaho . . . Ashwell points out the largest silver and lead mine in the world at Kellogg . . . Here too is a government emergency airport . . . right on the sec-

(Continued on page 294)

Breaking the Ice for Aviation

by WENDELL REID

The author, a Nova Scotian, recalls and tells of the early work of the Aerial Experiment Association in which Alexander Graham Bell, Glenn Curtiss, J. A. D. McCurdy and F. W. "Casey" Baldwin made aeronautical history.



McCurdy's Silver Dart, making the first flight in the British Empire, at Baddeck, N. S., February 23, 1909.

THE progressive spirit of aviation was introduced into Canada on the first day of October, 1907, when Dr. Alexander Graham Bell, the inventor of the telephone, formed the Aerial Experiment Association with headquarters at his home near Baddeck, Nova Scotia.

In his choice of members for this organization, Dr. Bell was no less thorough than in his previous efforts that gave to Canada and to the whole civilized world the greatest invention of the past century—the telephone.

At the first meeting of the newly formed organization, Dr. Bell was elected chairman, Lieutenant Thomas Selfridge, secretary; J. A. D. McCurdy, treasurer; Glenn Curtiss, chief executive and director of experiments, and F. W. "Casey" Baldwin was appointed chief engineer and, in addition to fulfilling these duties, each member undertook an active part in the construction of the Association's aircraft.

F. W. "Casey" Baldwin and J. A. D. McCurdy were graduates in engineering from Toronto University, Glenn Curtiss was an expert on gasoline engines and Lieutenant Selfridge was an officer in the U. S. Army who later became one of the most prominent flyers of his time in America.

As a result of this meeting and within a short space of time, a man-carrying tetrahedral kite was built. This craft, with a structure of 3,000 small tetrahedral cells covered with red silk, was powered with a Curtiss engine and when completed was christened the "Cygnet" by Mrs. Graham Bell.

A fast steam driven boat assisted in the launching and Lieutenant Selfridge. after whom Selfridge Field the note U. S. Army Air Force base is named, piloted the Cygnet on her maiden flight and, after attaining an altitude of 168 feet, succeeded in landing safely on the water. Recording instruments were placed at convenient parts of the kite and from these much important data was obtained.

Due to winter conditions in Nova Scotia it was found necessary at this stage to move headquarters to Hammondsport, New York, where a series of gliders were built in which flights of between 200 and 300 feet were made. The most important result of these flights was the experience gained and the knowledge that, with further development, longer flights were possible.

After much study a more modern type of airplane was built following a design suggested by "Casey" Baldwin. This machine, the "Red Wing," was a biplane of very clean design powered with a 40 H.P. Curtiss V-8 air cooled engine weighing 148 pounds. The propeller weighing 19 pounds, made of steel, had two blades 6 feet 2 inches in diameter with a pitch of 4 feet. The tapered wings had a spread of 45 feet and an average chord of 5 feet 3 inches.

On March 12, 1908, "Casey" Baldwin successfully flew the Red Wing, taking off under its own power from skis, after a run of approximately 150 feet along the ice surface of Lake Keuka. On this occasion, the Red Wing, flying at an altitude of 20 feet, attained a speed of 30 M.P.H. and covered a distance of 319 feet. This is believed to be the first public flight of an airplane in America.

However, many hazards were yet to be overcome for, a few days later on March 17, 1908, the Red Wing was forced out of control by a sudden gust of wind and was completely wrecked.

These undaunted pioneers of the air next proceeded to build the White Wing, a machine equipped with movable wing tips, now known as ailerons, an idea devised by Casey Baldwin and patented in the name of the Association and which with other patents was sold to Glenn Curtiss some time later.

The White Wing took off on wheels under its own power from a large meadow and, after successfully covering distances up to 1,000 feet, suffered the fate of its predecessor. These, and other successful flights by the Wright brothers, aroused an increased interest in aviation and the Scientific American Trophy was offered by the Aero Club of America for the first flight of a heavier-than-air machine over a prescribed distance of one kilometer.

With a view of capturing this trophy, the Aerial Experiment Association built a new airplane which they named the June Bug and, at Hammondsport with Glenn Curtiss at the controls, the June Bug broke all previous records in the presence of the Aero Club of America, by flying a distance of 5,090 feet in 102½ seconds. The Association thus became the holder of the Scientific American Trophy.

So encouraging were the results of these experimental flights that the inventors increased their efforts to build a machine having improved stability and longer flying range, and with this thought in mind they began to work on a new model, which when completed, was named the Silver Dart.

This machine was equipped with a 50 H.P. V-8 water-cooled Curtiss engine very similar in appearance to the present day Curtiss OX5, the engine being used with indirect drive. An interesting feature of the cooling system was the location of the radiators, which were of the flat type attached to the wings. This plane weighing 900 pounds was 30 feet long, 10 feet high and had a wing span of 48 feet, and was built to carry two passengers side-by-side.

Successful test flights were made at Hammondsport before the new plane was shipped to Baddeck, the birthplace of the Aerial Experiment Association and the home of Dr. Bell. On February 23, 1909, the Silver Dart, with J. A. D. McCurdy at the controls, took off after a run of only 100 feet, along the ice covered surface of the Bras d'Or Lakes and flew a distance of 4½ miles over Baddeck at the rate of 40 M.P.H. This was the first flight of an airplane in the British Empire.

Over 300 flights were made by the Silver Dart during her career and, on some occasions, she successfully carried two passengers.

The Aerial Experiment Association, having accomplished the purpose for which it was established, was dissolved by mutual consent of the members on March 31, 1909, and after its dissolution, the members continued their efforts for the improvement of aircraft construction.

In the summer of 1909 Messrs. Baldwin and McCurdy formed the Canadian Aerodrome Company with the object of interesting the Canadian Government in the use of aircraft as a national asset in time of peace and war. These men referred to their machines as aerodromes thereby adhering to an old theory of Dr. Bell's that as they did not contain a flat surface they could not be called a plane. The company built two all-steel constructed planes, the Baddeck Nos. I and II, which were successfully flown at Petawawa, Ontario.

The most difficult problem at that time was the financing of the various projects of the company as no income was available from outside sources due to the lack of confidence on the part of the capital interests. Foreseeing the futility of their efforts without increased revenue, Messrs. Baldwin and McCurdy dissolved partnership.

The development of aircraft was advanced at the cost of many lives and among them was Lt. Selfridge, who was killed in a crash while flying with Orville Wright at Fort Myer, September 17, 1908. He was buried in Arlington National Cemetery, Washington, D. C.

Dr. Bell died on August 2, 1922, and was buried at Baddeck. The name of Glenn Curtiss, who died on July 25, 1930, still lives in a number of Curtiss patents which are adopted in the most modern type of aircraft.

Of the group, Glenn Curtiss alone persisted in its further development and commercial advancement. In his first planes, known as the old Curtiss "Tripods," the general design closely followed the layout of the pushers developed by the Aerial Experiment Association, the use of ailerons being a necessity because of the patent situation and the Wright's claim to wing-warping priority.

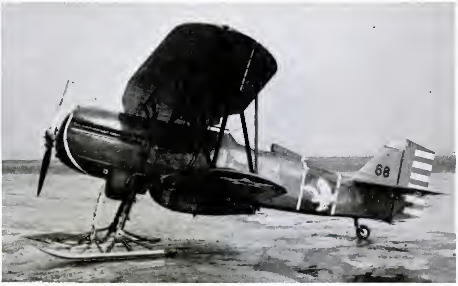
And while the Aerial Experiment Association, undoubtedly developed many of the practical details of the airplane as we know it today, yet there were many other experimenters and investigators both in the United States and in Europe.

The total result was a long series of patent interferences and patent litigation that continued for years with Curtiss bearing the brunt of the battle. The Wrights contested the control system and the Farmans of France hindered progress by injunctions restraining American builders from using landing gear wheels.

But still, and all, the Curtiss planes and hydros still bore the earmarks of the June Bug, White Wing and others of the Association planes until finally the first Curtiss fuselage model appeared—the progenitor of the old Model "R" and the Curtiss JN series.

J. A. D. McCurdy, who in February, 1911, established a new world record for the longest flight over water by flying from Key West, Florida, to Havana, Cuba, is now president of the Curtiss-Reed Flying Service, Limited, in Montreal, and Casey Baldwin, who is at the present time a member of Parliament in Canada, has the satisfaction of seeing all airplanes of today equipped with the same means of lateral control, namely, the aileron which he designed for the Aerial Experiment Association.

Curtiss Hawk in Winter Sports Garb



Sure enough, here is the Curtiss Hawk on ice.

AT the offices of POPULAR AVIATION, we've seen the Curtiss Hawk P6-E in all sorts of shapes, conditions, formations and elevations, but believe us or not, this is the first time we've seen the P6-E out skating on the ice. The Army Air Corps is to be complimented upon the neat compact skiis fitted to this little ship which apparently do not add much to the parasitic resistance.

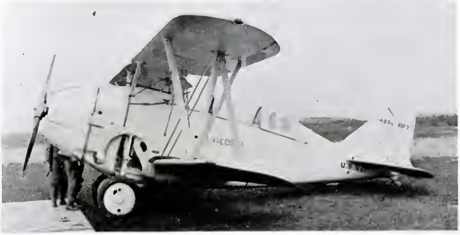
This particular ship was photographed at the Chicago Municipal Airport after its arrival from the 17th Pursuit Squadron, Selfridge Field, Mich.

While the skiis look like a simple accessory or appliance, yet we have the word of a number of army officers that there was a whole lot of development work on them before all of the bugs were ironed out. In the first place the material used for the shoes was of importance, second came the problem of the alignment mechanism and third was the proper location of the skiis in relation to the rest of the ship.

The Grumman Navy Fighter XSF-2

THE Grumman Navy Fighter shown by the accompanying photograph is a typical Grumman with its distinctive type of retractable landing gear, but unlike the previous models, this plans is equipped with the twin-row Wasp engine which makes a marked difference in the outlines of the cowl.

Speaking of this type of gear reminds us that we have a photo of an old time Chance Vought, dating back to about 1920 which is provided with a very similar type of landing-gear. And so, as we have often remarked before, it is mighty difficult to find anything new in aviation where a million inventors have been working for thirty years or more.



Side elevation of the Navy Grumman.

Flying in Switzerland

by M. D. WILLIAMS

It will be of interest to the thousands of prospective American visitors to Switzerland to know that the magnificent mountain vistas can now be witnessed from the air.

TO THE average observer Switzerland, with its limited area of 15,737 square miles and its mountainous territory, may seem of only negligible importance as far as aviation is concerned. But the land of the Alps, which is served by the most marvelous electrified railway system in the world, by spectacular funiculars galore, and great automobile highways which zigzag their way up to dizzy heights, has definitely become airminded.

Switzerland's very location, in the heart of Europe, has predestined it to become an integral point in international air traffic, and to also view the beauties of this tiny land from the air is nowadays more and more the desire of visitors who have succumbed to its irresistible charm.

At present, some sixteen international airlines from all directions of Europe lead to Switzerland and the majority of these air lines feature powerful express planes in which foreign travelers at a speed of from 260-300 kilometers per hour, and even greater, are whisked between mealtimes from their everyday surroundings to realms of Alpine splendor.

Truly remarkable, in this respect, is the service provided by Swissair (for whom Imperial Airways act as General Agents in Great Britain) on the London-Basle-Zurich air route. This service, which was inaugurated on April 1, 1935, has brought the Alps within three hours of London.

So enormous has been its success from the start that it is now being operated throughout the year. The trip in this instance is made by twin-motored Douglas air liners. The cabins are heated, ventilated and noise-proof, and stewardess service and light luncheons are provided. Each of these spacious flying Pullmans is equipped with the latest aeronautical devices and improvements including a robot pilot.

The Douglas DC2 machines used by Swissair on these international lines have reduced the flying time between Paris and Basle to one hour and 40 minutes. From Amsterdam or Berlin, Switzerland is reached in three hours and 40 minutes and equally swift connections are to be had from other European centers.

For aerial sightseeing in Switzerland, circular trips over cities and one to three-hour excursions over the Alps are flown from the aerodromes at Basle, Berne, Geneva, Lausanne, St. Gall and Zurich. These Alpine air excursions include mountains such as the Säntis, Glärnisch, Tödi, Rigi, Titlis, Jungfrau, Finsteraarhorn, Blümlisalp, Matterhorn, Mont Blanc, also the Bernina range and various other peaks in the Grisons. Inci-

Just one example of the inspiring views of the Swiss Alps as seen from one of the Swiss air transports.

Flying over a Swiss city with its winding river marks a diversion of scenic beauty.

Stunting for the movies over the Alpine peaks.

Another view taken from a sightseeing plane in the Swiss Alps.

dentally there is a much patronized winter service for Alpine flights and connecting trips at Arosa, Davos and St. Moritz, noted resorts in the canton of the Grisons.

Alpine flights are only made in clear and favorable weather, the Air Transport companies always keeping in touch with the Swiss Meteorological Head Office. Inasmuch as ascents and descents are made gradually there is, on medical authority, no danger of impairing a passenger's health. The maximum altitude reached on a one-hour flight is 2,800 meters, on a two-hour-flight about 4,200 meters, and on a three-hour-flight 4,500 meters.

During the past seventeen years, thousands and thousands of air passengers have been taken over the Alps without a single fatal accident. Besides, every passenger holding a valid ticket is adequately insured with a Swiss Insurance Company against injury, disablement or death.

In Switzerland airplanes have long ago been pressed into service for the location of stranded alpinists, and food supplies, medical kits and blankets subsequently lowered to such parties from the air have often proved life-saving factors. The Swiss Air lines have a number of planes which can easily be transformed into first class flying ambulances.

Amateur flying has in recent years been successfully encouraged by the Swiss Aero Club by means of well organized meets, tours and formation flights. Foreign pilots are assured of a most hearty welcome by this club, who invites such prospective visitors to write in advance for any desired information to: The Secretariat-General of the Swiss Aero Club, Waisenhausplatz 2, Berne, or to the Propaganda Office of the Swiss Aero Club, Gubelhangstrasse 22, Zurich-Oerlikon.

Switzerland is also an acknowledged Gliders' center. Thus, under the sponsorship of the Swiss Aero Club, a big International Gliders' Meeting was held on Jungfraujoch, 11,340 feet a/s, last September.

END.

A Zeppelin airship and a Dornier flying-boat over Lake Constance.

Europe's Famous Woman Pilot—Maryse Hilsz

MARYSE HILSZ, the brilliant young French flyer, who recently won the Hélène Boucher Cup race for women flyers, is undoubtedly one of the most interesting figures in the European skylanes.

In the brief span of five years, since she started her career, she has had over 2000 hours flying experience and now has a list of records and long-distant flights to her credit, that might be envied by any flyer.

Three different times she has set new world-altitude records; her intra-continental jaunts have carried her over the burning heat of the Sahara and the steaming jungles of equatorial Africa; not once, but several times, she has followed the trail of Marco Polo and Persia, India, Malay, China and Japan have flashed beneath her wings.

Even the fantastic tales of that famous explorer of the middle ages, do not stir the imagination more than the adventures of a lone flyer in those unchartered skies, and the volatile, voluble French, who love the dramatic, have been quick to give her due credit for her achievements.

Indeed, the brief outline of those flights as Miss Hilsz jotted them down for us, tells an amazing tale of the skill and courage of this daring flyer. In 1930, the year she first began to fly, she made a tour of the French possessions in Northern Africa: Morocco, Algeria and Tunisia. In the winter of 1930-31 she made her first solo-flight to the far east, from Paris to Saigon, Indo-China and return.

The next year she flew to Madagascar, which lies off the southeastern coast of Africa, and on this trip she achieved the distinction of being the first woman to fly solo across the Sahara Desert. It was in this same year that she hung up a new world-altitude record for women pilots.

In 1933 she flew from Paris to Hanoi, Indo-China in the record time of five days, returning to Paris via Tokio, Japan. Then in the following year she broke her own record by flying to Tokio, by the way of Saigon, in the same length of time. This trip was made in a Bréguet military plane, and after she returned to Paris she was sent on a tour all through central Europe, to demonstrate the ship for the government.

Miss Hilsz still holds the altitude record (23,843 feet) for light planes, but the record of 36,982 feet for high-powered ships, which she set this fall was broken just two days later, when the Marquise Carina Negrone of Italy, drove her ship to the new high of 39,139 feet.

In the Hélène Boucher Cup race, the first international event of its kind for women pilots, Miss Hilsz, flying a Bréguet 27-4 equipped with a Gnome et Rhone 800 horsepower motor, covered the distance of approximately 430 miles between Paris and Cannes, in 2 hours, 29 minutes and 6 seconds. The first prize for this race carried 40,000 fr., in addition to the beautiful trophy.

Diplomats of the Airways

by MARJORIE C. DRISCOLL

A story containing the complete specifications for the airline hostess whose official purpose in life is to keep the travelling public sold on air-transportation and on one air-transport line in particular.

CAN you make a confirmed pipe smoker put away his pipe without a protest?

Can you make out a passenger manifest, check baggage and arrange ground transportation for a dozen passenger, all going to different places?

Do you know how to get flies out of the cabin of an airplane? Can you get along without using scarlet nail polish and costume jewelry?

Do you know why a plane banks to land?

Can you remember names? Can you determine which passengers want to be talked to and which want to be let alone—and do it?

If a girl can do all these and a few dozen other things; if she's a trained nurse not more than 26 years old, weighs not more than 118 pounds, is equipped with steady nerves with a ready and pleasant smile and the tact of a diplomat, she may qualify for eventual selection as a Transcontinental and Western Air hostess.

For, when officials of the line decided to employ air hostesses, they went into a huddle and emerged with thirty-one typewritten pages that sounded like the specifications for the ideal girl and which covered every possible contingency of air travel.

Quoting from System Operations Circular No. 100, Revised:

"As the passenger is the guest of the hostess, she must be a diplomat in analyzing the preferences and anticipating the wishes of each passenger."

Meet Miss Anna L. Lines, a TWA air hostess, carrying a specially designed hostess kit-bag. There's everything in it but the kitchen stove.

Miss Isabel Judkins, TWA air hostess, demonstrates that scarlet finger nails are out so far as the airline is concerned.

And that's merely page one of the thirty-one pages, introducing the subject of air hostesses.

Personal appearance, to start with:

Uniform, including hat, worn at all times on duty. Uniform jacket to be worn, except during specially designated summer periods. Natural or medium shades of nail polish only. No costume jewelry. No extreme lipstick or cosmetic effects.

Don't offer the hostess a drink when she's on duty or in uniform. Alcoholic beverages are forbidden her on duty and for twelve hours before a scheduled trip starts—and that goes for beer, too. Again, she mustn't smoke while in uniform and in any place open to the public.

Writers of air stories, who make the hostess address the pilot as "Bill" and let him call her "Babe", aren't writing about TWA. It's "Mr." and "Miss", on duty.

They're wrong again if they picture a hostess spending her leisure time in the pilots' cabin. Three minutes—that's the TWA limit; just long enough to transact necessary business connected with the trip.

As a matter of fact, what with a required trip through the cabin and back every twenty minutes, day and night, and all the rest of the things she has to do, a TWA hostess doesn't have much leisure time.

Even if there should be no passengers on the plane, she may not sleep or read while aloft.

A "trip" for a TWA hostess begins one hour before a scheduled departure when she must be at the field to inspect and tidy up the cabin, check her own kit and find out from the pilot how long he expects the flight to take, how high he will probably be flying and what speed he plans to make—this, so that she may answer the passengers' questions.

When the passengers arrive, she stands, with the passenger manifest in hand, in the rear of the cabin—and the rules provide that her feet must be in just such a place so that no one can trip over them. It's her job to see that everyone gets aboard who is entitled to, and to take a last look around for possible stowaways. It's also her job to see that seat-belts are fastened during the take-off, explaining why this is done.

She's in her own seat, with belt fastened, when the plane takes off, but within five minutes she must make her first trip through the cabin, collecting tickets and getting the passengers settled.

By this time, she will know her passengers' names so that she can say: "Yes, Mr. Jones, it looks like a good trip."

Hint to passengers: Don't call the hostess "Blondie." Her name is posted

Pipes are forbidden, so Miss Isabel Judkins, TWA air hostess, graciously persuades a customer to part with his pipe and substitutes a permitted cigarette.

on the front wall of the cabin, and it's good air travel etiquette to call her Miss So-and-so. Early in the trip, she finds out tactfully whether you want attention and conversation or not. If you want to be let alone, she won't bother you.

After she has finished collecting the tickets and making out her report, she hasn't a thing to do until meal time except answer questions, distribute newspapers and magazines, adjust chairs, provide writing trays and stationery for the inveterate letter writers, give special attention to children aboard, explain how the ventilators work, watch the cabin temperature and keep it as near 70 degrees as possible, point out scenic features along the route, tell inquiring passengers how high and how fast the plane is flying, pick up scattered newspapers and other debris, provide blankets and pillows for chilly or sleepy passengers, keep an eye on the health and comfort of passengers, and answer questions.

If a stowaway fly buzzes around your head on a TWA plane, call the hostess. A fly swatter is part of her kit. If a lot of flies have sneaked aboard, she herds them up to the front of the cabin, opens the door of the pilots' cabin, asks the pilot to open his side window— and whoosh! out go the flies.

The ultimate of tact is called for when a passenger goes to work on a cigar or a pipe—cigarettes are permitted aloft.

The hostess dons her prettiest and most effective smile, gently approaches the human furnace, and says softly into his ear—a section of Rule 12, D, instructs the hostess never to speak directly into the face of a passenger:

"I'm very sorry, Mr. Blank, but pipe (or cigar) smoking is not permitted in the plane, as it tends to make many passengers sick."

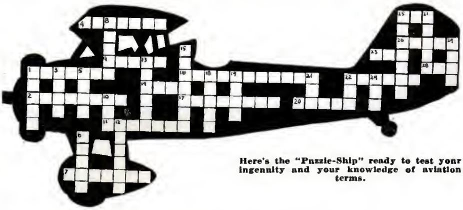
With tact equal to that required of a hostess, the circular continues:

"If he insists on finishing the cigar or pipe that he has already started, there is nothing further that can be done. However, very few smokers will start a second cigar and insist that it is their privilege to make several other passengers sick after they have been advised."

(*Concluded on page* 300)

When you speak to a passenger as Miss Judkins is doing, address your conversation to his ear and not in the general direction of his face.

Here's an Aviation Cross-Word Puzzle
by SIDNEY PERLMAN



Here's the "Puzzle-Ship" ready to test your ingenuity and your knowledge of aviation terms.

AVIATION cross-word puzzles are probably the most difficult of all cross-word puzzles because there are such a limited number of words in the "aviation language".

However, after much labor, the following puzzle was concocted which contains only aviation words. There are no fillers, no foreign or Latin words nor anything outside of everyday airport usage. Therefore, if you know your aviation, there is no necessity for getting out your cross-word dictionary to chase up such stunners as "Eros", "Pneumos", "Ria" and similar monstrosities that appear in conventional puzzles. The spirit of the puzzle is reflected in the form of the outline.

And now, Puzzle Phans, let's get a nice soft pencil and start in on the job.

HORIZONTAL LINES

1. When one wing of a biplane is set ahead of the other we have......?
2. A horizontal rudder.
4. A complete wreck.
7. A built-up wood sheet.
9. Good old solid..........
11. You have to have one to fly.
14. Swinging around the longitudinal axis.
16. Firing before the end of the stroke.
17. A balloon.
20. A member of that takes compression.
22. Surrounding the cylinder.
23. A short projecting metal ear.
25. The vertical distance between biplane wings.
26. Toothed wheels.
28. Initials of a well known airline.

VERTICAL LINES

1. Fast forward motion.
3. Shaft carrying wheels.
5. The landing.
6. Stopped in mid-air.
8. To guide.
10. Lubricate.
12. Incoming gas movement.
13. Twisting moment.
15. An airplane with two superposed wings.
18. To ground.
19. A sudden blast of wind.
21. It goes on a bolt.
22. A carbureter nozzle.
24. A revolving irregularly shaped engine valve part.
25. They are placed over the eyes.
27. The first name in a firm of engine builders.
29. Wing-beam.

The answers to this puzzle will appear in our next issue. However, it should not be difficult to check back through this type of puzzle to insure your accuracy without waiting for the May issue. Beginners may even drag out their old data sheets or the Slang Dictionary.

The English Now Hunt the Hare by Plane

THE English — great people for "shootin' and huntin'" that they are —have invented a new sport; bagging hare by airplane. It's tough on the hare and tough on the planes, too, if the pilot happens to be a novice. But the idea is taking the flying populace by storm.

Started by instructors at Royal Air Force training schools, the sport requires for success proficiency in crazy flying, hedge-hopping and other amusing and amazing types of sky technique.

There are two ways of taking your wife home a hare for supper—that is if you're going to use a plane for the job. Either you swoop low over the wide fields of the English countryside and attempt to hit the unfortunate animal with a wheel as the machine skims a bare inch or two above the grass; or you land in a field in which there are hares and try to catch them by unorthodox taxying. Either way provides thrills—and, sometimes, rabbits.

Maybe Ripley would have a hard time gaining credence for this story, but if you don't believe it, the writer will try to get an affidavit from one of the lucky instructors at his flying training school who still raves about the rabbit—hare, rather—that he bagged with the port wheel of his Avro Tutor.

Lyman Gilmore, Jr.,—Pioneer

by F. LELAND ELAM

A most remarkable story, telling of two old cabin monoplanes built twenty-five years ago that very greatly resemble modern cabin transport planes. And the inventor is every bit as interesting as the planes.

TWO years ago, an airplane hangar stood on the Gilmore landing field at Grass Valley, California. In it was a large cabin plane and a small one, long neglected, but both startling revelations to aeronautical engineers of the last few years.

A few months ago they passed into oblivion when the hangar burned. They were built by Lyman Gilmore, Jr., of Grass Valley, almost twenty-five years ago, and when constructed they were ahead of the world in airplane design by almost a quarter century.

It is unbelievable that a man could have built such airplanes and flown one without becoming famous, but according to all records and available information that is exactly what happened.

These airplanes alone should have made Gilmore world famous as an airplane inventor. Other accomplishments should have made him still more famous but each time, for some reason fame passed him by. Why? That is the question which is hard to explain and understand.

Gilmore was to busy inventing to rush out and grab fame as it was passing and, if fame is not grabbed when it is at your door, it passes you by, pushing slowly on to be grabbed by some other person. Several times fame would have been Gilmore's for the taking but Gilmore was always shy and too modest for his own good.

Then, there is the fact that Gilmore was so far in advance with his aviation ideas that it made people think he was a little queer, and this resulted in lack of financial support from people who were in a position to push him into the notice of the world, even though he made no attempt to do it himself.

Lyman Gilmore, Jr., standing in his hangar with the fuselage of his great plane behind him, taken just before the fire.

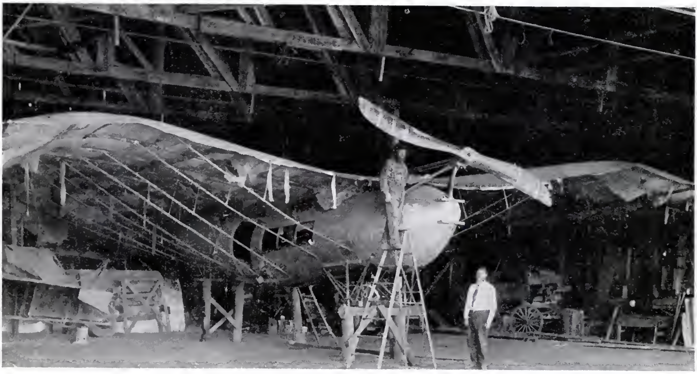
Credit and glory for discovering the secret of flight went to other men. But old-timers in Grass Valley and in the mountains surrounding the city, who knew Gilmore in his prime, say that Gilmore, long before others, had actually discovered the proper method of keeping ships aloft. Willingly they now admit that Gilmore was a genius.

The story of Gilmore's adventures in aviation follows. Those who knew him since his youth and others who have known him in more recent years report every word of it is true.

In 1891, Otto Lillienthal, German engineer-scientist, after 30 years' preparation, took to the air in his glider of waxed cotton cloth stretched over a frame of peeled willow wands. He launched himself from a springboard in his own garden. The wing area of the glider was 107 square feet and the passenger rested himself on his forearms, his body hanging below the wings.

This same year, Gilmore attached flapping wings to a bicycle, amid the scoffing of friends, and rode down hill. Everyone thought he was a little off on the subject. By manually flapping the wings the affair would rise into the air and sail for a short distance. The machine was a little unwieldy and lacking in balance.

This feat gave the boy encouragement. He developed other ideas which he put


A close-up view of the great 8-passenger cabin plane in the Gilmore hangar, shortly before this old relic was burned. Gilmore is standing in front of the plane which had been neglected and which was almost in ruins.

into effect. He made a set of drawings and went to work. He and his father disagreed about spending all of his time on development of his flying ideas so he left home. He came to Redding, California, during a railroad strike. There being no work available because of the strike and having nothing else to do, he set about building a glider with an eighteen foot spread.

This was in 1893. When the glider was completed he towed it to the top of a hill. A horse was used to tow the glider. It left the ground and was sixty feet in the air when the horse looked back and saw the strange affair. The horse lunged into a scared run and the glider smashed to the ground.

At about this same time, Sir Hiram Maxim, English inventor and scientist, built the largest experimental plane known, but he did not permit it to fly. This plane, which was 110 feet long and weighed three and a half tons, lifted itself from a half mile railway track. The inventor had invested $200,000 in the machine, so when it began to raise, he turned it over on its side because he had not put landing gear on it and he did not want it to crash wrecking his experiment.

In 1894 Gilmore made his first successful glider flight in a ship he built himself. It glided 500 feet at an altitude of fifty feet. A year later, when Percy Sinclair Pilcher, former British navy sailor, began to build birdwing gliders, Gilmore began designing a cabin job monoplane with thick wings.

Gilmore had been doing some gold mining so when funds began getting low about this time he entered the mining game seriously. Gold meant money and money meant airplanes to him.

He established his workshop in the mountains near his work where there were cliffs and rising air currents. He decided that the only way of learning about flying was to study the birds in their flight. They knew the real secret of flight balance he reasoned and his future plans depended on his knowing it too.

It was while studying the birds, in their native haunts that he conceived the plans for a plane that bears such a close resemblance to the planes of today. He looked into the future and visualized an airplane passenger service in cabin planes.

During time taken off from mining, Gilmore continued to work on with his gliders—always improving them. He found he could glide in still air and operate fairly well but when the air was gusty or there was a fairly heavy wind, the glider became unmanageable and he went into a nose dive or a side slip.

Gilmore was, at this time, experimenting with a motor powered glider type plane. He had estimated from the fact that a weight falls 16½ feet the first second, and gains velocity each second until its resistance is equal to the force of gravity. That if his plane moved around 80 feet per second, there was no chance of falling.

(*Concluded on page 280*)

One Way to Get a Car Across-Country

Just an artist's fancy turned loose but this stunt may be realized in the near future.

THERE seems to be a big drive on, at present, toward carrying motor cars, tanks and trucks across country under a plane, bomber fashion. Christie, he of front wheel drive fame, has proposed the same idea in his army tank service and one or two others have broken down with the idea during the past few months.

The airplane is undoubtedly the ideal machine for distributing motor cars or trucks during the time that the arterial highways are impassable or in war. The plane carries the car to the desired spot, good roads or bad roads, and then deposits the car and leaves it to its own devices. For local hauling or on islands during a flood, this system might easily prove a means of saving many lives.

Atwood's Air Flivver Successful

by J. EDWIN GOTT

AN airplane made of wood, yet practically fire-proof and bullet-proof, has been invented by a Milford, N. H., furniture company official, Harry N. Atwood. A test model, with Col. Clarence D. Chamberlain at the controls, flew more than 130 miles per hour on its first flight with a 36 horsepower Aeronca motor.

Chief Eugene L. Vidal, of the Bureau of Air Commerce, has had the inventor in Washington to consider the application of the wooden airplane construction to the fool-proof "tailless" airplane designed by Waldo Waterman. The Atwood invention deals with structural material whereas the Waterman invention involves design.

The first ship built by the Atwood process, a single-seater, weighs slightly over 500 pounds and costs about $1.00 per pound to produce with a fair percentage of profit. Birch veneer and a thermo-plastic substance are the chief materials used in the Atwood plane. Forms are built up the size and shape of the twelve main parts of the ship,—the wings, the fuselage, the rudder, the ailerons, etc.

Over these forms is wound thermo-plastic treated birch veneer, 10 and 20 thousandths of an inch thick and in strips about two inches wide. The first layer is wound at one angle and the next layer in the opposite way. This winding is continued until the desired thickness is obtained.

The individual parts are then coated with the thermo-plastic and metal plates are clamped over the section. A rubber bag is sealed over the part, it is then placed in a pressure chamber where steam is applied to cause the thermo-plastic to run and then cold is applied under pressure to harden the part.

After it is removed from the chamber it is slipped off the form and the shell-like part is completed ready for assemblage. No struts nor wires are used yet the ship meets all the requirements for strength and strain. If a plane, built of this material, is set on fire when at a height of several thousand feet it can be landed before any serious harm is done. A bullet shot into it will puncture the structure but will deprive it of little strength.

Those associated with the development point out that the material, which is known as "Duply", makes it possible to build a plane at low cost. The basic substances used are comparatively cheap, the type of labor used is inexpensive. Furthermore, the lightness of the plane built of "Duply" provides for low cost of operation.

She Will Wing Over China

by MARJORIE C. DRISCOLL

Katherine Cheung, the heroine of this biography, is a licensed pilot with more than 250 air-hours to her credit. She hopes to organize a flying school for girls when she returns to China.

WHEN the Chinese government authorities decided, four years ago, that there would be no room for girl students in the newly organized flying school at Canton, they took Katherine Cheung of Los Angeles away from her piano and put her in the cockpit of an airplane.

Eight thousand miles across the Pacific, on the other side of a wide ocean from the flying school where Chinese boys were learning to navigate airplanes and Chinese girls were wishing they could, Katherine Cheung decided that she would do something about it. So the pretty daughter of a Los Angeles Chinese business man turned her slim shoulders on a promising musical career and got grease all over her dainty fingers while she was learning the internal workings of an airplane motor.

Now Katherine Cheung is a duly licensed pilot with some 250 hours to her credit, a plane of her own, a good record in races, and a very definite plan as to what she is going to do with her flying skill. She is going back to China, work for the government at something that involves flying, and eventually organize a flying school where the girls will have the first chance and the boys can wait their turn.

Katherine Cheung comes from Canton; the city that will be a very important aviation center for China when trans-Pacific air travelers land at Macao, not far away. Her family preceded her to Los Angeles, while she stayed in Canton to finish high school.

In 1927, she was graduated and crossed the Pacific to join her people. Music, then, was Katherine Cheung's special interest. She entered the College of Music of the University of Southern California, studied piano, and became an accomplished performer. She still plays, but music has become a recreation to be indulged in when it isn't a good day to fly.

About 1931, Katherine Cheung heard from some of her friends in Canton about the flying school that wasn't open to girls. It was not that the authorities objected to girls learning to fly, but so many young men were clamoring for instruction that there simply wasn't room for the girls.

Like most young people of college age, Katherine Cheung was more or less interested in flying. Sometimes she had thought that she would like to learn, but music took most of her time. Then came the letter from Canton, and suddenly her mind was made up. Here she was in California, with a chance to do things, and there were all the girls in China, equally ambitious, equally eager to keep up with their brothers, but held back by lack of opportunity.

Katherine Cheung decided that she had found her job. She told her family that she wanted to learn to fly and they, proud of her determination and her ambition, told her to go ahead.

Her first instructors were Captain Wilkington, who gave her her ground school work, and William Gage, with whom she studied actual flying. Twelve and one-half hours of flying instruction and she was off for her first solo. Later she worked with Tommy Underhill and now she is studying blind flying with Joe Plosser and acrobatics with Earl Ortman, holder of the Vancouver-Agua Caliente speed record.

Katherine Cheung outlines the feminine aviation situation between flights.

When National Aviation Day was celebrated at the California Pacific International Exposition at San Diego, a dozen women pilots staged an accuracy race between Los Angeles and San Diego. It was not a speed contest but one which involved navigational problems, maintaining a previously estimated speed, and complying with rules designed to test accuracy of flying. Katherine Cheung placed fourth. She placed second in another California cross-country race for women pilots.

Chinese residents of Los Angeles, proud of the progress being made by a girl of their own people, did a very graceful thing. They, the business men and merchants, clubbed together to buy an airplane for Katherine Cheung, not merely because she happened to be a Chinese girl who had learned to fly but because they appreciated how seriously and with what determination she was going about her plans.

So now she has her own Fleet, and it is one of the hardest worked privately owned airplanes in Los Angeles.

Miss Cheung flies at least an hour every day, working at acrobatics, cross-country flying, navigation and other problems. She has her private license but, not eligible for citizenship, she cannot qualify for a transport license even though her preparation is sufficient. However, since her ambitions are centered on her native country, she argues that after all she can learn just as much, even if she is denied official recognition.

She is studying acrobatics because, she says, they are something which a well-rounded flyer should know and she is equipping her plane for inverted flying for the same reason. She was the first Chinese member of the 99 Club, the nation-wide organization of women flyers and, so far as she knows, there is only one other Chinese girl pilot in the country—Miss Ya Ching Lee of San Francisco. Miss Cheung is very definite about her hope to see aviation training made available to girls in China.

"I don't see any reason why Chinese girls shouldn't be just as good pilots as girls anywhere," she said. "They are a long way removed from the tradition-bound Chinese women of a generation ago. They drive cars, so why not airplanes?

"And China, with its vast area and lack of other transportation, is the ideal field for air development. Think of all the great interior waiting to be opened and brought into touch with the rest of the world. Airlines are beginning to reach into it, but there is a tremendous amount to be done."

As for the ability of women to pilot transport planes—always a subject of heated argument—Miss Cheung sensibly thinks that it depends on the woman, Chinese or otherwise.

"We can't all be Amelia Earharts, but some of us can," she said. "Not all men would make good as transport pilots, so I don't believe it is possible to set down hard and fast rules."

Her own hope, as a preliminary to organizing the flying school, is to fly for the Chinese government, perhaps as a publicity feature to demonstrate the possibilities of aviation and woman's share in it. The army flying she is willing to leave to the men. But before she goes back to China, she wants to learn everything that America can teach her.

(*Concluded on page* 284)

Britain's Flying King

From the Bulletin of British Aircraft Manufacturers

KING EDWARD VIII made aviation history on the first day of his reign, when he flew from Sandringham to London. He is the first British monarch to fly.

For years, in his own phrase, the new King has looked upon flying as his main means of transport. He has flown extensively in the British Isles and overseas. He has owned more private aircraft than any other Englishman. His example has done much to help civil aviation through the difficult years of the past decade.

The King is no fair-weather flyer, and apprehensive, ill-informed people frequently exclaim at the imagined risks he runs in the air. They ignore, not only the extremely high standards of safety reached by the modern airplane, but also the long experience on which the King founds his decisions whether or not he will go by air in difficult weather. Himself an able pilot, though he has never officially qualified for a license, he brings the calm judgment and knowledge gained in many hundreds of hours aloft to reinforce the opinions of his pilot whenever a difficult decision must be taken.

Up to the present, the King has owned ten airplanes. Before 1929 he flew almost invariably in a Royal Air Force machine, but in the summer of that year he acquired for his own use a Gipsy-Moth open-cockpit light biplane. In 1930, this modest craft was supplemented by two Puss Moth light cabin monoplanes, which a year later were replaced by two later models of the same type.

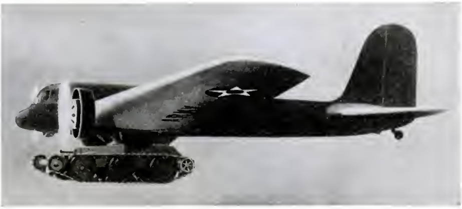
In November, 1932, he bought a Fox Moth cabin biplane, losing something on cruising speed as compared with the Puss Moths, but gaining more cabin accommodation and space for luggage. This was to be the last of the small, single-engined kind of airplane in the King's fleet.

In the spring of 1933 he acquired a Dragon biplane and a large Vickers-Viastra monoplane, each of them equipped with two motors. The Dragon was arranged to carry six passengers and the Viastra twelve.

Early last year the King disposed of the Dragon and the Viastra; the latter is now engaged on special radio research for the Air Ministry. In their place he purchased two Dragon-Rapide biplanes, each fitted for the luxurious accommodation of five passengers. Like all of his earlier machines, the Dragon-Rapides are decorated externally in the scarlet and blue of the Brigade of Guards. The wings are silver. They carry the British civil registration markings G-ACTT and G-ADDD respectively.

Two Gipsy-Six 184/205 h.p. engines provide power in the Dragon-Rapide. Economical cruising speed is 133 m.p.h. and maximum level speed, with full load, is 157 m.p.h.

Is the Christie Flying Tank Practicable?



Here goes the artist's conception of the Christie tank carrying ship in full flight.

WALTER J. CHRISTIE, a veteran automotive engineer and a pioneer in the front-wheel-drive type of automobile construction, has just promoted another highly original idea that is being given consideration by the U. S. War Department.

The tank element of the assembly has been given exhaustive tests and has proved itself an exceedingly fast and maneuverable weapon on the ground, being capable of approximately 90 m.p.h. when running along the road on its caterpillar tracks. Just how the idea will work out when carried by a plane is yet to be demonstrated, but it will undoubtedly mark an advance in tank tactics.

The ability to pick up a tank and deliver it close to enemy country within a short space of time, multiplies the usefulness of the tank a thousand-fold. By this means, the tank can be spotted quickly at the point where it is needed without the necessity of running it over hazardous trenches, shell holes and other impediments.

Aviation Book Reviews

by POPULAR AVIATION STAFF

AS a result of mentioning two very interesting books by F. J. Camm several months ago, POPULAR AVIATION has had many calls for "Power Driven Model Aircraft" and "Model Aeroplanes and Airships." A few copies of "Model Aeroplanes and Airships" are still available. This book presents in simple language the first principles of aviation and how to apply those principles to flying models. The information is up to date and there are chapters on a Simple Tractor Monoplane, A Long Distance Tractor Biplane, A Fuselage Monoplane, Model Helicopters as well as some half dozen chapters on "How to Build Model Aeroplanes." For the benefit of the gliding sections of model flying clubs there is a chapter on Full-Size Gliding.

"Power Driven Model Aircraft" tells about model aircraft mechanism and has special constructor's chapters.

ELEMENTS OF DIESEL ENGINEERING, by Orville Adams. The Norman W. Henley Publishing Co. First Edition 1936, 451 pages, Price, $4.00.

An easily understood introductory manual for the student, mechanic, operator and practical engineer, suitable for home or school use. It covers comprehensively, the operating principles of all types of air injection and direct injection Diesel engines, giving instructions for selecting types best suited for various applications, outlining development of American and European high speed automotive Diesels, discussing all factors underlying design of various engine components and presenting complete rules for maintenance and repair, with full instructions for servicing and operation in the shop and in the field.

This book includes much original data based on Mr. Adams' operating and servicing work on Diesel engines for over twenty years. He has also made a complete research of the entire field of Diesel engine literature.

The development and application of the Diesel engine is one of the most promising and lucrative fields in America today and the purpose of this book is to instruct the mechanically minded young man and engineering student with essential information. Questions and answers at the end of each chapter present a clear review of the contents. Aviation Diesels are covered in great detail.

HENLEY'S TWENTIETH CENTURY BOOK OF FORMULAS, PROCESSES AND TRADE SECRETS. Revised Edition, 1935.

A valuable reference book for the home, factory, office, laboratory and workshop. It contains ten thousand selected scientific formulas, trade secrets, chemical recipes, processes and money saving ideas for both the amateur and professional worker. Complete glossary of terms as well as a buyers' guide and chapter on useful workshop and laboratory methods make this as indispens-

(Concluded on page 294)

Laying-Out a Propeller

by RAOUL J. HOFFMAN

Because of the requests made by many of our readers, we had Mr. Hoffman supplement the data given by his nomograph in the March issue. This nomograph, together with the following data, will be of great value to the amateur propeller maker.

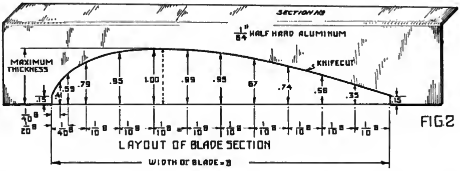


FIG 2

LAYOUT OF BLADE SECTION

After determining the principal dimensions of your propeller by means of the nomograph or "alignment chart" in the March issue of POPULAR AVIATION, we are again faced with many problems in the actual layout and construction of the propeller which were not previously explained.

Many amateurs wrote to us, after the publication of the nomograph asking for further information on the subject, and in response to their requests I will show just how the actual layout is made in the shop and how the finishing operations are performed. In proceeding with the following description, I will assume that you have already determined the pitch and diameter of the propeller from the nomograph and that you have carefully studied the matter of blade-section, horsepower, speed and other essential factors entering into our problem.

Our first step will be to locate the various "stations" or locations (1-2-3-4-5-6-7) of the various blade-sections along half the diameter of the propeller. The basis of measurement is the propeller diameter (D), previously determined from the chart, and to locate the stations we will study Fig. 1 in which the propeller hub is at the left and the tip is at the extreme right of the drawing. Just as an example, we will assume a propeller diameter (D)= 60-inches.

Starting at the left, with the hub, we see that the horizontal base-line is drawn from left to right, and that the center-line or "axis" of the hub is drawn at right-angles to this base-line. The size of the hub is determined by the engine-shaft diameter and the size of the propeller flange which will be described later. The hub, as will be seen, is built up of thin boards or "laminations" glued together, the thickness of these boards varying from ¼-inch to 1-inch according to the diameter of the propeller.

All of the station lines (1-2-3-4-5-6-7) are located from the hub center-line at intervals that are proportional to the propeller diameter (D). Thus, the distance of Station (1) from the hub center is .075D, or, .075 × D. In our case, with the diameter equal to 60-inches, this will be: .075 × 60=4.5-inches. From (1) we measure off the distance .15 × D to the next Station (2), and so on, up to the tip at the extreme right of the drawing.

Having located the station points along the base-line, we now erect verticals through the points to form the lines marked (1-2-3-4-5-6-7) which are the basis of the location of the blade sections.

Next, we locate the pitch-center (P) on the hub center-line by measuring off a distance from the base-line equal to the pitch of the propeller divided by 6.28. In our case, this is: $\frac{60}{6.28}=9.554$-inches. The pitch, it is understood, was previously determined by the nomograph from the given engine and propeller speeds.

From the pitch-center (P) draw lines through the various intersections of the station verticals with the base-line as indicated by the slanting dotted lines. The angles made by these slanting dotted lines are the various blade angles at the different stations which,

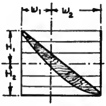


FIG.3.

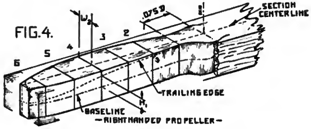


FIG.4.

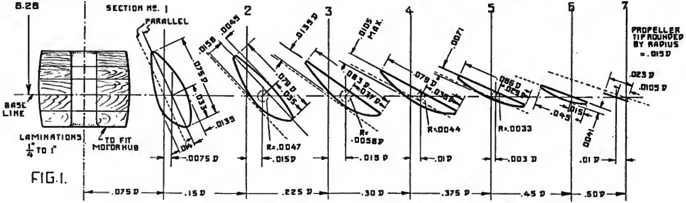


FIG.1.

—LAYOUT OF PROPELLER · ALL DIMENSIONS MUTIPLIED BY THE DIAMETER D.—
REQUIRED: DIAMETER, PITCH, DIRECTION OF ROTATION, DIMENSIONS OF MOTORHUB.

as will be seen, increase toward the hub and diminish toward the tip.

Further examination will show that the location centers of the various blade-sections do not occur exactly on the station line intersections, but that the section chord lines are off the center of the lines (1-2-3-4-5-6-7), by a slight amount. Thus, the intersection of the chord line of the first blade-section at Station (1) lies to the right of Station (1) by the amount .0075 × D. The next section, at Station (2), is distant from (2) by the amount .015 × D, and so on at all of the stations.

In order to easily locate the chords of the sections, small circles, having the radius (R), are drawn on the latter intersection points as determined above. The radius (R) of each of these small dotted circles is given on the drawing at each station. Lines are now drawn tangent to the circles and parallel to the dotted pitch-lines for locating the leading and trailing edges of the blade-sections.

With the "tangent-lines" drawn, we now locate the leading and trailing edges of the blade-section from the intersection points. At Station (2), for example, we see that the leading edge of the blade-section is located at .035 × D from the base-line intersection. In our case, this is equal to: .035 × 60= 2.10-inches. The width of the blade-section at Station (2) is: .079 × D, or in our case, .079 × 60=4.74-inches. The "camber," or maximum thickness of the blade can be found from a similar operation and the outline of the blade-section can then be drawn in.

Our next step will be to layout the blade-sections by following the outline of the BASIC BLADE-SECTION shown by Fig. 2. It is of importance that we maintain this exact curvature to obtain the given results. Fig. 2 is a template that can be made of sheet tin, aluminum or cardboard, but preferably of half-hard aluminum sheet, .006-inch to .015-inch thick. Use a sharp pointed steel scriber for marking out the section—not a pencil—and then follow the section with a knife. By bending the blade-section back and forth, it will break off easily and the template can be finished with a slight filing. This method saves time, and as there are many templates to be made, this is of importance.

Knowing the dimensions of the engine hub, which can be taken from the hub or flanges of the engine, we can locate the propeller hub at the correct height. Take the dimensions (W1) and (W2), as shown by Figs. 3-4 and lay them out on the section center-line, adding ½-inch to the outline, squaring it and then we have the dimensions of the propeller block.

The wood to be used for the construction of the propeller depends upon its diameter and the number of revolutions per minute. White pine can be used for the small propellers, oak, birch, walnut or mahogany for the large ones. The laminations are from ¼-inch to 1-

(*Concluded on page* 290)

Why College Men Take to Aviation

by EDMOND KELLY

Bill Hosmer, and many college men like him, not only get a big kick out of aviation but find it a source of spending money as well.

BILL HOSMER is just an ordinary twenty-two year old boy. He is a pretty serious kid with a slow drawling sort of a smile and his steady, straightforward look meets you squarely in the eye.

The thing that makes Bill stand out among others is that he is a few years ahead of his time. Bill is an undergraduate of the University of California but a post-graduate in the art of flying.

When he was eighteen, Bill received his private pilot's license in San Diego upon the completion of the course of training at the Ryan School of Aeronautics. Then Bill went on with school, making his major sport flying. After a year of this he went back to the Ryan School and finished up his training to the point of receiving his transport pilot's license.

Now Bill is a Senior at the University of California and spends his week-ends hauling people around on cross-country trips and makes good money doing it. For his own pleasure he owns a Great Lakes, two-place open cockpit plane, which he uses in going to and from school. Naturally with so many assets as Bill has in his make-up, he couldn't dodge the fraternity boys, so early in his career he made Sigma Alpha Epsilon.

Nowadays, it is Bill's turn to do the pledging and he says that once you get a rushee up to six or seven thousand feet in a plane it isn't too hard to "put the button on him." There isn't a brother in the University of California Chapter of S. A. E. who hasn't at some time or other flown with Brother Hosmer.

During the last Christmas holidays Bill had a little territory to cover and he left San Diego on the 28th of December for the state of Washington. Bill always speaks of states. If he leaves San Diego for Chicago, it's always "I'm going to Illinois," and when he gets to Chicago, it's "I came in from California."

The first day out on this trip Bill landed in Oakland after an uneventful trip. The next day he started out in the face of bad weather and got only as far as Reddings, California, where he was forced down by fog for the remainder of that day and the next. On the thirty-first Bill went on to Fort Lewis, Washington.

When he was asked if he flew over Mount Shasta, he said that it was plenty cold enough at the 8,000 feet that he had to fly to get past it without trying any altitude records. There was one moment which rather stands out in Bill's memory of that trip. The ceiling was very low and he had about one mile visibility, but right under him was the railroad track.

Any pilot who has done cross-country flying knows of the solid comfort afforded by that ribbon of track so easy to follow. All pilots have followed them, but some have had to go along dusting off the tops of the poles for the telephone company when the visibility was very bad. That is what Bill was doing when suddenly the track ducked into a tunnel in the side of a mountain.

Bill said that called for a vertical bank in the right direction without loss of too much time. Bill told us the story, so I suppose that he made the vertical in the right direction. After New Year's Bill headed south, making Medford, Oregon, in five and one-half hours from Fort Lewis, through a little rain which missed him because he slunk down in his seat and let it bounce off the windshield.

The next day he flew from Medford to Bakersfield, California, in six and a half hours, and on the last day of his trip he got back to San Diego from Bakersfield in two and a half hours.

The Gliding and Soaring World

by SPEED WESTPHAL

Chit chat with the boys who are doing big things in gliding and soaring, both in this country and abroad.

IN opening this month, I wish to thank all of the many gliding clubs and individuals for the fine Xmas and New Year's cards which I have received. This is rather late to offer my thanks, but better late than never as the old saying goes.

* * *

LT. COMDR. RALPH BARNABY, the President of the Soaring Society of America, has just made his exit from the Naval hospital at Pensacola, Fla. He landed there after a flight in the new Sky-Louse because one of his tonsils appeared to be slightly heavier than the other.

Speaking about the Sky-Lice, I discovered that, due to the possibilities of one of these contraptions making its way to the Municipal airport in Los Angeles, four dogs have left for parts unknown. I also understand that the makers of "Flit" are working day and night in preparation of a grand reception for this ship in the United States.

Harold McMickle, prominent member of the S.S.A. and for some time past a test-pilot for the Pan-American-Grace Airways, Lima, Peru, was killed in an air crash on last Xmas eve. All of us who knew Harold, will remember him as a swell fellow and a fine friend.

* * *

EDMUND T. ALLEN, pioneer glider pilot, and distinguished Aeronautical Engineer, has just returned from Europe with news which should make us do some serious thinking. In the Hornberg soaring school, 120 students are enrolled each month of the year. "Winch-towing" has almost entirely replaced the usual practice of automobile or airplane tow-off. Blind flying is required of all glider pilots competing in the highest grade and 3,000 to 5,000 glider pilots are trained each year.

* * *

TED BELLAK is now manager of the Bowlus-DuPont Sailplane Corporation, Wilmington, Del. He informs me that this company will soon hit the market with a "Utility" glider in kit form; that is, if they are successful in securing a home-builder's license from the Department of Commerce.

* * *

"CHET" DECKER, President of the North Jersey Soaring Association, is leading a group of "Franklin" glider owners who are dickering with the Department of Commerce for new permission to airplane-tow their ships. For some reason or other the D. of C. has discontinued special waivers for airplanes towing these gliders.

It is believed that the Department's decision is based on the fact that no stress was ever turned into them and that most of the "Franklins" flying today are more than four years old. "Chet's" idea is to secure permission to airplane-tow these gliders behind the smaller and slower planes. If any of you "Franklin" owners are interested and have any ideas, you might contact "Chet" Decker at Glenrock, N. J.

Briegleb in Kingfish glider landing on a California Beach after stunting over the sea. A scene from "Air-Minded," an M.G.M. feature film.

* * *

GUS SCHEURER, Frank Zaic and Kurt Siemon have worked out a fine glider launching winch and have it fully described with drawings in the January bulletin issued to all members of the Soaring Society of America. In case you have a Club or are otherwise interested in this device, I would suggest that you write for a copy and also become a member of the S. S. A. Their address is Soaring Society of America, U. S. Naval Air Station, Pensacola, Fla.

* * *

"DON" C. STEVENS and yours truly have opened a gliding and soaring school at the Los Angeles Municipal airport and the first week of operation found us with 15 students enrolled. Among this number are many of the stars of stage, screen, and radio, such as little Jackie Heller, Harvey Stephens and others of equal fame.

There is one thing about training out here in California and that is, the movie stars join in sooner or later and that leads to a lot of publicity which is good for any game—gliders included. The divorce stuff don't pull so well any more, so they are going in strong for gliders.

Wonder if we can get Wally Beery to side-track his Bellanca for a time and do a little work without the big put-put up in front? Might be well to contact his manager.

We might push this thing a little further and pull off an all-star feature with the supes being pulled along behind a tow plane.

* * *

HARRY PETERSON, President of the Grey Gull Gliding Club of Chicago writes me that they have received a license on their Mead primary and at present are putting it in shape for summer activities. Also from the Windy City comes words that the Glen Ellyn Glider Club have completed work on converting their "Waco" primary into a secondary and will soon be up in the clouds.

* * *

JOHN C. HOSS, member of the Cactus Glider Club, with Kent Patton and Ben Kunz also of Golden, Colorado, informs me that they have traded their sixshooters in for one good primary and one slightly used secondary. They have done some soaring near the city of Denver and expect to do a lot more when the summer rolls around.

* * *

FRANK KELSEY, President of the Airport Glider Club, of Salt Lake City, Utah, again writes me about their activities which seem to be plenty. These boys ran into a little state law trouble, but things have cleared up and the boys once more have their heads above water and are able to swim or glide, or whatever.

* * *

NOT that I want to infringe on Ripley's copyright, nor do I wish to be an aeronautical Walter Winchell, but believe it or not, I ran into a man down here in Los Angeles who still prefers hang-gliders to the more advanced type.

This strong legged individual, who never grew too old for a scooter, is "Bob" Morse, well known West Coast glider pilot and member of the Southern California Soaring Club. During our conversation, he produced a photo of his last hang-glider which was named the "Condor", and was constructed in 1934. "Bob" confessed that it had all the ear-marks of a grasshopper, but after all, what's in a name anyway.

The empty weight of the glider was 135 pounds and, after sight-weighing the pilot I'd say the total weight loaded was 325 pounds. Seven degrees of dihedral takes care of the lateral stability, while the rudder and elevators are connected to a single control stick. I'm not so sure just how this worked out, but I'll bet when he pushed the little stick down, the glider came down and 'round. If my boss, J.B.R., can find room, you will find the picture of this American ground-louse along with this article. (Well, here it is, Speed. Ed.)

* * *

I MIGHT tell you right here, that the M.G.M. studios have changed the name of our glider picture from "Airminded" to "Airhoppers". Incidentally, this "Pete Smith Short" should be showing in your locality along about this time.

I have received so many letters from individuals and clubs who have been having plenty of trouble training their students and members that, beginning with the next issue, I will attempt to give a complete course in gliding and soaring. This will include everything from the first ground tow, to the cross-country soaring flight. There will also be lots of dope on selecting and developing a good soaring site, so be sure and follow this page from month to month.

* * *

HARVEY STEPHENS, M.G.M. movie star, who is now on vacation after completing "Whipsaw", is one of the first stars to complete his gliding course at the Municipal Soaring school which operates at the Los Angeles Municipal airport and we'll be hearing of him.

Right at present, Harvey is considering the purchase of a Briegleb "Utility" for his personal use. This will make the fourth order for this new glider which is proving itself so popular out here on the West coast.

* * *

JUST what progress powered gliders will make in this part of the country is just as doubtful as predicting what progress they will make in any other part of the country. The idea is nothing new, and they have been playing with the two-goatpower ships ever since the days of Santos Dumont's Demoiselle.

There are a few feeble attempts around here at installing mother's Maytag washing machine motor on top of the wing with a sort of Kodak folding arrangement.

* * *

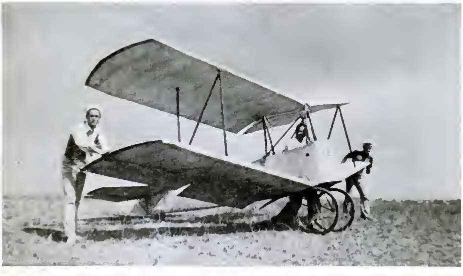
MEMBERS of the Southern California Soaring Club have really been doing things out here where the sun shines all the time. What? . . . O'K', maybe it does rain five days a year—so what?

Anyway, several weeks ago, Fred Barnes soared Jay Buxton's two-place glider (with passenger) over the Palos Verdes ridge for four and one-half hours, remaining for the duration of the time at an altitude of higher than 3,000 feet.

On the same day and at the same location, "Don" Stevens made a flight of 1 hour and 40 minutes; Franklin Wolcott soared for 1 hour and 20 minutes and several other pilots brought the total soaring time for the day up to eight hours. It might interest you fellows to know that this ridge is located right on the Seacoast and within 15 minutes drive of Los Angeles.

* * *

AND now to close up shop for this time after a review of the follies of the West Coast. So far, this year, we've had the bulge on you fellows in the east and central west, because of our well known weather, but I hope the next mail brings stories of achievement in your part of the country.



A glider built in 1933 by Bob Morse, Los Angeles, Calif. The "Condor" made a flight of 150 yards at a height of 15 feet. It weighs 135 pounds and has a wing span of 24 feet (upper wing) and 22 feet (lower wing).

Gas Mask Drill by Women

This is a rather weird and ghastly scene, but in fact, it is only a few English girls preparing for the worst in case of war.

SOME months ago we ran quite a lengthy article on the subject of poison gas in war and the precautions that were being taken by many nations in preparing for airplane gas attacks.

In the above picture we show a picture of a drill being made by the feminine members of the British Gas Protective Society at a girl's school. The members are not only instructed in the use of the gas mask itself but they also are drilled in making their escape from buildings during a possible bombardment.

Ryan Makes Big Sale

RYAN Aeronautical Company, San Diego, Calif., announces that they have sold fifteen of the Ryan Type ST low-wing monoplanes to W. H. Irwin, Atlanta, Ga., who represents Air Service, Inc., at Candler Field.

It is believed that this is one of the largest, if not the largest, order for private type airplanes ever placed. This plane is rapidly gaining in popularity and this order attests its suitability in the service of the private pilot.

High-Lights and Side-Lights

by M. A. RODDY

Pertinent notes upon the progress of aviation and brief notes on the aviation personnel. Read the snappy paragraphs dealing with the doings of the month.

A flight of Martin bombers at the recent U. S. A. maneuvers.

YESSIR, the new Congress has been seated and the "working" lawmakers had better wear two-pants suits as an indication that there are going to be plenty hot seats when the air-mail legislation starts popping.

* * *

OPERATORS have withdrawn from the Aeronautical Chamber of Commerce and have formed the Air Transport Association of North America with Colonel Edgar S. Gorrell, former A.E.F. chief of the air services, as "czar" with the avowed purpose of a united promotion and development of the industry.

Other officers of the new association are: W. A. Patterson of the United Air Lines, vice-president, and Fowler Barker, secretary-treasurer.

* * *

CO-OPERATIVE steps already undertaken by the airlines include air script whereby transportation can be purchased at discount on a mileage basis, and the endorsement of "airsurance" providing for lower insurance premiums, and the signing of contracts with the Railway Express Agency by twenty of the twenty-three domestic lines and Pan American, which will permit unified handling of air express through 23,000 offices in the United States and 32 countries and colonies abroad.

Plans are also under consideration for the standardization of specifications for large transcontinental transport planes which would result in savings through the avoidance of retiring perfectly good equipment, which is now necessary every two years or so.

* * *

HENRY FORD of Model T fame is building a new flivver PLANE which will be powered by one of his newest V-8 engines.

It was the Dearborn manufacturer who built the first transport which made it possible for airlines to pay expenses with the help of a small mail subsidy. Remember the old Ford Trimotors developed in the early Nineteen Twenties?

While Mr. Ford is experimenting with his flivver plane, an autogiro has been completed which will fly 150 miles an hour and which has both a zero landing-speed and a zero takeoff speed which will enable the pilot to land on a lawn or a wide strip beside a highway and without leaving his seat, it will be possible for him to taxi along the highway at twenty or thirty miles an hour and park his craft beside his car in the family garage.

* * *

CAPT. EDDIE RICKENBACKER is of the opinion that, by 1940, there will be regular scheduled flying over all of the oceans which will be crossed by planes carrying forty or fifty passengers, operated very much as present ocean liners with a captain, pilot, co-pilot, engineer, steward and stewardess.

Only in emergencies will the captain be on the bridge and the landing of the ship will be like the docking of big boats and all passengers will be able to telephone from the airplane. A recent survey in international air travel made by the United Air Lines indicates that before next summer a traveler may be able to buy for approximately $3,000 a single ticket which will take him by air from an American port around the world.

* * *

CHICAGO'S island airport evidently will remain in the blue-print stage for a little while as a result of President Roosevelt's refusal to RELEASE funds for the project. . . . However, improvements are being made daily at the Municipal Airport by John Casey as two million was awarded for development to the old field.

W.P.A. engineers have approved plans for the conversion of old ferry slips as skyports for giant seaplanes and flying boats which would terminal on the East River at Twenty-third Street. . . . Boston and Bermuda services are also anxious for waterfront facilities near midtown.

* * *

ANNOUNCEMENT has been made by the American Association for the Advancement of Science that there are many benefits for aviation in the development of the new "third eye," or electron image tube, which can see the infra-red rays.

Perfected at the laboratory of The Radio Corporation of America by Dr. Vladimir K. Zworykin and Dr. G. A. Morton, the tube would make it possible for an airplane so equipped to "see" a completely dark field by sending out only "black light" from an infra-red beacon.

As yet the tube is unable to penetrate actual fog. Military night maneuvers would be greatly simplified through use of the tube while on the defense hostile airplanes would be readily detected since the airplane engine itself is a source of infra-red light.

* * *

THE Post Office Department has been hearing complaints by The American Air Lines and The Air Line Pilots Association against the Braniff Airlines, Inc., air mail contractors on the routes between Dallas, Tex., and Chicago and between Amarillo and Brownsville, Texas, charging violations of the Air Mail Law through operation of a parallel service between Dallas and Chicago via Tulsa and violation of the wage scale provisions of the Air Mail Law.

* * *

ALTHOUGH no decision has been officially handed down as yet, regarding the pilots pay question, I am reliably informed that first pilots will receive full base pay from date of employment and co-pilots will be paid according to the provisions of the Air Mail Law.

* * *

UNITED AIR LINES' statisticians have figured out that when their company completed ninety-three million miles of flying on January first, the air transport company had covered approximately the distance between the earth and the sun which doesn't mean that it has been a "light" year either for the company report also discloses that gross income for 1935 was approximately $8,500,000 of which $3,000,000 was for carrying mail.

* * *

PENNSYLVANIA AIRLINES reports an increase of 185 per cent in passenger traffic for 1935, carrying 40,237 passengers while C. R. Smith, president of American Air Lines, states that upon the first anniversary of American Airlines' southern transcontinental route from Newark to Los Angeles via Washington and Dallas, more than 95 per cent of the scheduled trips had been completed and more than 5,000 passengers carried over the run which is the only line to have sleeper planes on its night flying divisions.

* * *

ACCORDING to H. S. Darr, president of the Chicago Aviation Corporation and general manager of Curtiss airport, near Glenview, Ill., miscellaneous aircraft operators of the United States flew more miles in the first half of 1935 than any other previous similar period since 1921. Darr's figures show that miscellaneous operators, which include flying services, schools, photographic flying, crop dusting, and private fliers, flew 40,234,785 miles and carried 556,332 passengers.

* * *

DEWEY ELDRED of Willoughby, Ohio, is giving flying instructions to members of the Lake Erie College Flying Club, which is the first women's school in the United States to organize such a club. At present thirty girls are attending ground school courses one night a week while eight are taking actual flying lessons.

* * *

PROFESSOR, if you please, George C. Haffley has resigned his position with American Air Lines to accept an appointment as instructor of aeronautical engineering at Sacramento Junior College and is now wearing a cap and gown instead of a mechanic's jumper.

* * *

I KNOW that you have occasionally heard of a pilot losing control of his ship but did you ever hear of a pilot losing his pants? Well, I did. It seems that in the early days of the airmail Pete Bransom, while flying on a hot night over Georgia, took off first his shirt and then later his pants as it was rather humid in the cockpit and Pete wanted to cool off.

Suddenly he hit a down current which lifted him out of his seat and his pants out of the plane. The pants fell over Georgia but there was nothing over Pete when he landed at Atlanta where there were a number of women around the airport. Just another good argument for two-pants suits.

* * *

And so I finish this month's message with greetings to all readers. I thank all of you for the many kind letters sent to me in the past few months.

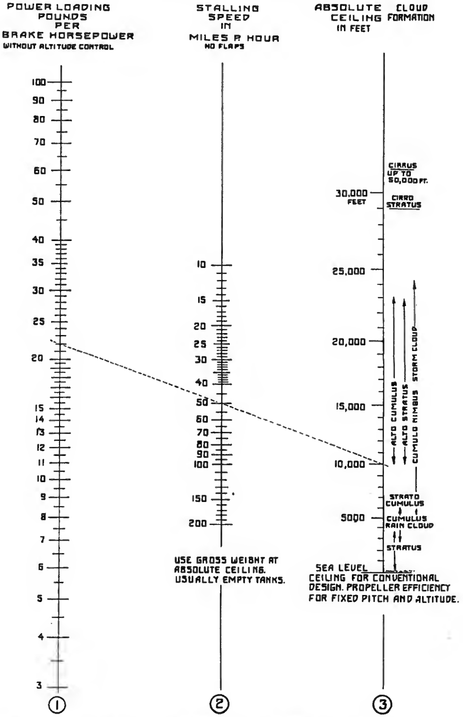
A Nomograph for Stalling Speed and Ceiling

by RAOUL J. HOFFMAN

ONE of the most important of performance relations is that existing between the power-loading, or pounds per horsepower, the stalling speed and the absolute ceiling or the greatest height to which the plane can ascend. As an additional item of interest, I have also shown the approximate elevations of the principal cloud formations.

Knowing the sea-level stalling speed in miles per hour, and the power-loading in pounds per horsepower, we have a means of determining the maximum altitude obtainable with this equipment from the accompanying chart. In plotting these quantities, I have assumed that no flaps are provided with the plane and that the engine is not provided with altitude controls of any type. Supercharging is not considered.

Having determined the loading per horsepower by dividing the weight by the brake-horsepower, we draw a straight line from the computed horsepower on the left hand scale through the known sea-level stalling speed on the second scale and then project the line to the third scale at the extreme right where the ceiling will be found.



EXAMPLE: GROSS WEIGHT 880 LBS., ENGINE 40 BHP. STALLING SPEED 50 M.P.H. 880 DIVIDED BY 40 GIVES YOU 22 LBS P. BHP. CONNECT 22 ON SCALE №1 WITH 50 ON SCALE №2 THEN YOU FIND THE LINE GOING THRU 10.000 FT. ON SCALE №3.

About Eddie Rickenbacker

by JAMES FARBER

An intimate biography of our leading ace whose pre-war background is even more interesting than his wartime exploits.

CONTRARY to a widely published yarn that began during the war and which has never been exploded, Eddie Rickenbacker, king-pin ace of the A. E. F., does not have the significant and romantic middle name Victor. It was a nice piece of imaginative work on the part of some reporter and it's a great shame that the Ace's parents weren't endowed with the foresight to give it to him. Perhaps they would have if they'd known—

But they called him Vernon.

And his friends couldn't get used to that so they called him Eddie or Rick. And they still do. So why shouldn't we?

Much has been written about Eddie but if you will take the trouble to investigate, you will find that it is largely piecemeal and incidental. Eddie wrote a book about his experiences, but for obvious reasons a man is likely to fare better at the hands of an independent investigator. He might also fare worse, but with Eddie such is not the case. He began his career (so far as we are concerned) with a crowning disappointment.

As you doubtless know, he was one of America's premier race car drivers long before we entered the war. He finished his public school education in Columbus, Ohio, displaying the while, a knack for taking automobiles apart to see what made them go. He found out. And then automobile men found him and desired his services. It was then but a step into the seat of 100 m.p.h. speedsters. He took the step in his stride. It wasn't long before he was known on all the major automobile racing circuits in the country.

Eddie was in London, in 1917, when America decided to defend democracy with ball ammunition and trinitrotoluene, giving an opportunity later on for the world's Mussolinis and Hitlers to demonstrate that other forms of government could be put on a paying basis. But in those unenlightened times, Eddie, with thousands of his fellow citizens, was persuaded that here was a great opportunity to discharge his duties as a citizen and distinguish himself at the same time.

He forgot about racing cars and weighed anchor for home. It was his idea to band all his racer friends together into a crack air unit. Former President Teddy Roosevelt had some such idea, it will be recalled, but such visionaries as he and Rick were flatly turned down.

The United States, after all, has not the same viewpoint—or necessity—for volunteer soldiers as does France with her famed Foreign Legion—and later, her Lafayette Escadrille. But let's pause for a moment for a word picture of the man who was to exceed the fabulous Lufbery in aerial exploits.

Most photos of Eddie Rickenbacker reveal him as a smiling, dimpled, pleasant-faced fellow and you simply can't help being misled by these impressions of the camera's eye. Actually, Eddie is not by nature a jovial soul. He is good natured and those who count themselves his friends are very fond of him and those who know him, but number themselves among his "severest critics" will admit that his is, indeed, a likable disposition.

Mentally, Eddie is very alert but his mind prefers to cogitate its problems and to calculate their solutions to their very Q. E. D.'s. He is a thinker, this Ace and one who has thought his way out of more jams than many men can think their way into. Watch, and I'll make a this a minor Q. E. D. in this study of the renowned "Rick."

Here is the smiling face of Eddie Rickenbacker as he appeared a few months ago.

One more descriptive word: Eddie is a big man. Physically he was literally head and shoulders taller than Raoul Lufbery, Rene Fonck and Charlie Nungesser—those dapper gentlemen who blazed their names into immortality throughout the stricken skies of France.

When you think of it, this physical attribute is a noteworthy fact. Lester Maitland is a strapping fellow but Albert Hegenberger is not. Foulois was chosen years ago by the Wrights to be the first army pilot because he weighed only 122 pounds. (Oh, yes, and because he showed plenty of "stuff," too.) Roscoe Turner is a six-footer, but John Macready is slight. And so it goes. Flyers are most often medium in size, it seems.

But let's get Eddie over to France.

He got across as special chauffeur to General Pershing. It was a pretty smart idea. There's nothing like seeing a war perched underneath the commander-in-chief's nose. You can very nearly pick your own box seat. Which was Eddie's idea: he was transferred to the air service at his own request on August 25, 1917, and was promptly bustled off to Issoudun for preliminary training.

So careful was he in his studies and so quickly did he grasp the work assigned him that when he applied for transfer to a fighting unit, he was turned down on the grounds that he was "indispensable to the training plans."

"Indispensable," Rick's mind mulled the idea.

"And lo, it came to pass that Edward, son of Rickenbacker fell and was stricken with great illness and was thus lost to the company of his friends, many sending to Jehovah great and loud wails.

"And behold, Pontius Pilot of the Winged Hordes at Issoudun in the land of the Gauls saith unto himself, 'Yeah, and Edward of the house of Rickenbacker is departed of us and laid low upon his back in mortal ailment. Nay, and we find him not indispensable to us.'

"So it came to pass that Edward, scion of Rickenbacker, rose he from his couch of illness after ten and four days and saith he to Pontius, 'Ye have seen, verily that I am not indispensable to thy bidding as my feigned illness purporteth to show. Go to, and I beg of ye that I shall be removed to places distant and scenes venturesome.' "

Thus, might a scriptural-minded scribe relate the parable of how Eddie managed to get away from Issoudun.

On March 4, after a month at the gunnery school at Cazeau, Eddie joined the 94th Squadron, U. S. Army Air Service, at Villeneuve. He found that what the outfit lacked in machine guns and ships it more than made up in personnel. It had none of the former and plenty of the latter, all champing at the bit to paint their names on their own fuselages.

This very congenial crowd of pilots included Capt. Hamilton Coolidge, of Boston, Mass. (later killed after his eighth victory); Jimmy Meissner, of Brooklyn, N. Y., who emerged from the war with 8 E. A.; Reed Chambers, of Memphis, Tenn., with 7 E. A.; Weir H. Cook, of Toledo, O., also destined to get 7; Douglas Campbell, of Mt. Hamilton, Calif., with 6; Alan Winslow, Chicago, 2; James Norman Hall, of Colfax, Iowa, author of "Kitchener's Mob"; John Huffer, of Paris, France; Dave Peterson, of Honesdale, Pa.; and the already celebrated Raoul Lufbery.

Then, the squadron got ships and guns and no longer had to cadge both from the French. In the middle of April the boys moved to Toul, about 30 miles southeast of Verdun. Everything was in readiness for the future ace to begin his fighting career!

Rick made his maiden flight over the lines!

It still remains one of his greatest thrills. Yes, he will admit thrills, just as you and I would if and when we had them.

A maiden flight over the enemy was a thing apart in the life of every pilot, be he chasseur or bombardier. It was at once his baptism, his initiation and his graduation. It was his delivery of a personal calling card to the enemy. It was his "hat in the ring!"

Here he made the acquaintance of Archie and Herr Sausage. Archie was sent up to say "hello." Herr Sausage was aloft to observe his conduct and tell the boys on the ground whether Archie's welcome was warm enough. And the maiden pilot might chance to make the acquaintance of Herrs Heinie und Fritz, too, because there was nothing these gray-clad lads like better than to flatten steel pellets in a newcomer's engine—or his innards—as a welcome.

Eddie missed Heinie und Fritz but he saw Herr Sausage and felt Archie's hot and passionate breath.

He then began to receive the attention of the daring Lufbery and the gracious Huffer and Peterson. These men taught him their bags of aerial tricks and found him an apt pupil. They found him cool, precise, eager to learn and a trickster with his acrobatics.

The squadron was at Toul 24 hours when its own Katzenjammer Kids, Douglas Campbell and Alan Winslow went out and bagged themselves a pair of Germans. That was April 14. From then on the morale of the 94th was assured. Which is the true American temperament—to derive the greatest esprit de corps from an early good beginning. The French still can't understand it.

This first flight of the 94th was so close to home that most of the boys got to see it and it was a show well worth the time of any audience, indeed. Two Pfalz scouts having unluckily lost their way in a fog, inadvertently started to land on the Yank field! Winslow and Campbell were quick to take off as the enemy realized his mistake and took to his several heels.

Both were shot down nearby and next day, with considerable elan, were hauled into the public plaza at Toul and displayed—with plenty of ceremonies in the grand old American manner.

Then it was Rick's turn!

Two weeks later, Eddie sallied forth with Jim Hall and nailed his first Black Cross. It was a humble beginning but didn't remain so. In that month of May he bagged five E. A. and became an ace.

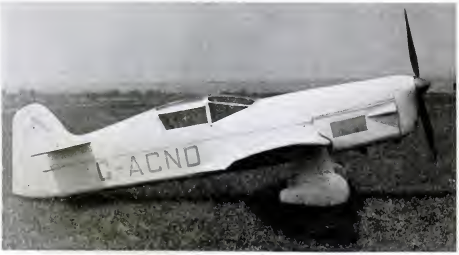
He just missed being America's first, that honor going to Campbell who got his sixth a day or so before Eddie "qualified."

There are no two ways about it, Douglas Campbell would have been Eddie's greatest rival for individual victory laurels during the war. But a few days after his sixth he got an explosive bullet in his

(*Concluded on page* 282)

The Percival "Mew Gull" Monoplane

(See front cover)



Side elevation of the Percival "Mew Gull", an English low-wing monoplane which has shown the excellent time of 218 m.p.h.

TWO views of the Percival "Mew Gull", shown herewith and in colors on the cover, show a lean lithe high-speed plane which has shown a speed of 218 m.p.h. in the Cardiff-London Air Races. In this race, it was piloted by its designer, Capt. E. W. Percival.

It is an excellent example of the clean lines possible with the use of an in-line inverted engine which, in this case, is a Gipsy 6-cylinder engine developing 200 h.p. It is a single-seater, somewhat similar to but speedier than the 3-seater Gull in which Mr. Percival flew to Africa from England and return in a single day.

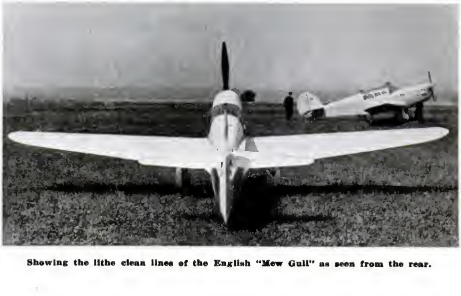
In general the performance can be given as: Top speed 218-m.p.h., cruising speed 190-m.p.h., landing speed with normal load 58-m.p.h. The take-off run is 210-yards while the landing run is 180-yards. Sea-level climbing rate 1,400-feet per minute. Ceiling 24,000-feet.

The pay-load, in addition to the pilot, is 200-pounds for 750-miles. The weight empty is 1,080-pounds and loaded, 1,800-pounds. The wing-span is 24-feet and the length is 20-feet, 3-inches. The 38-gallons of gasoline carried in the fuel tanks give it an approximate duration 42-hours.

The Mew Gull has an enviable list of winnings. It created a new time record in the King's Cup Race for 350-miles over a triangular course at the rate of 208.9-m.p.h. The same ship, but with a French 180-h.p. engine, won the Grand Prix of the Aero Club de France.

The seating is well to the rear, so far in fact that it rather recalls the Gee-Bee of past years in this respect and makes us wonder whether the "flywheelage is not excessive in maneuvering the ship as it was on the Gee-Bee with the weights so far from the center of gyration." This has an important effect upon the stability in yaw.

The continuation of the enclosure covering from the cockpit back to the tail-group presents a great deal of vertical area well to the rear which undoubtedly exerts a very effective damping moment.



Showing the lithe clean lines of the English "Mew Gull" as seen from the rear.

Stress-Analysis Made Painless

by JOHN B. RATHBUN

This is our response to oft repeated requests for a simplified series of articles on stress-analysis and strength of materials as applied to the construction of airplanes. The Managing-Editor of POPULAR AVIATION starts the ball rolling with this introductory article which will be followed by articles written by other engineers and designers.

IF THERE is a goat-getter, in the realm of aviation, that has received more publicity and cussing than another, that goat-getter is stress analysis.

Mr. Albert J. Amateur can digest the elements of aerodynamics and talk learnedly upon the subject of wing sections and their properties, but when it comes to the most elementary conception of stress analysis he gets all hot and bothered and makes for the nearest tree.

He usually gets an advanced text-book on stress analysis, takes one fleeting terrified glance at the mysterious symbols, equations and graphs, and then gives up the ghost without giving himself the slightest opportunity of picking up the most elementary features of the science. As is so often the case with a subject that we do not understand, the amateur then refers to this method of analysis as a "great big headache" and "a lot of theoretical bunk." Now, this is not fair to himself nor to the science but it is perfectly and absolutely human.

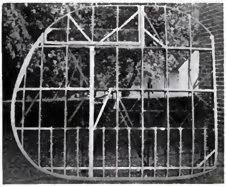
Mr. Albert J. Amateur forgets, or does not understand, that there are many varieties and brands of stress analysis, some by advanced mathematics, some by means of graphical solutions and others by simple comparison. The brand that gets into the amateur's hair is the brand that bristles with mysterious mathematical equations and complex diagrams that are just as intelligible to the untrained man as a Chinese laundry ticket written in the original Cantonese.

This, however, is not the sole method of making calculations or estimating strength but he, unfortunately, is brought into contact with this method more frequently than with the other and simpler methods. I know that this sort of discussion will not make a big hit with the conventional engineer, but I cannot help that.

Whether the strength of an airplane member is estimated by experience and judgment, by its appearance to the practiced eye, by guess-and-by-gosh, or by the use of the calculus, it is stress analysis just the same. Some men are more fluent guessers than mathematicians, some play by ear and not by note, while others push the old slide-rule to the conventional tune taught by the universities. Both methods have met with success and failure, but in the long run they all arrive approximately at the same objective by varying routes.

Please do not construe these statements falsely. Stress analysis of some sort is an absolute necessity, but the dread and hatred of making such estimates is bred in the fact that the science has been carried to excess by our authorities just as any other thing can be carried to excess, including cocktails and gin. In short, the whole trouble lies in the fact that there have been too many hair-splitting details and far too much slide-rule practice obscuring the true purpose of strength and stress calculations. These have discouraged the student long before he got a fair start.

Each part in this assembly of an airplane structure is subjected to a multitude of loadings and stresses which must be definitely determined before the proper distribution of material can be made to insure safety.



The delicate load carrying members of a wing structure must be carefully computed.

I will attempt, therefore, with the assistance of other engineers, to strike a happy medium that lies between simple guesses and comparisons and the ultra-mathematical treatment resorted to by the trained engineer. I will attempt to cover that old battle-ground fought over by the rule-of-thumb structural engineers and the collegiate breed many years ago in structural steel design.

This matter of stress analysis is nothing new nor is the conflict between the so-called "practical man" and the "theoretical man" that now wages. Formerly, bridges and buildings were designed largely by the eye of experience and by comparison with existing buildings and bridges rather than by mathematics and, strange to say, more of these old time buildings are still standing than those erected by the later crop of slide-rule pushers. This shows, conclusively, that there is no substitute for good hard horse-sense whether tutored or untutored.

But, now to get down to business and to end the argumentative side of the subject, we will take up the underlying units and principles relating to stress analysis and strength of materials. For the benefit of those who have only a hazy idea of what this stuff is all about, I will say that stress analysis relates to calculation of strength and loading in a structure, such as the frame of an airplane. It enables us to estimate the size of weight carrying members so that they will safely carry the given load under the assumed conditions.

The "load" is the weight acting on or carried by the plane, or its very numerous parts. The load can consist of the weight of the passengers, fuel, baggage, air-pressure on the wings or imposed by centrifugal force. And, no matter what the nature of the load may be, it is expressed as pounds in the English system of measurement or in grams or kilograms in the metric system. It can be a steady continuous load, it can be a slowly variable load or it can be a rapidly vibrating or reversible load, depending upon conditions.

It is interesting to note that the weight of the airplane, or its load, is not a constant quantity at all points or locations on the earth's surface. In other words, a pound is not always a pound—strange as it may seem. A pound weighed off exactly as a pound at the North Pole or less distance, will weigh considerably more at the equator in spite of the fact that the centrifugal force developed by the revolving earth at the equator is far greater than at the poles.

Again, an airplane will weigh less at an elevation of 20,000 feet than it does at sea-level, because it is farther away from the earth and the effect of its gravitational attraction for the plane is reduced. This would be of great practical assistance to aviation if it were not for the fact that the air also grows less dense at high altitudes and has less supporting value. In short, the gravitational pull of the earth exerted on a body depends upon the mass or bulk of the earth at that point and the distance of the body from the earth.

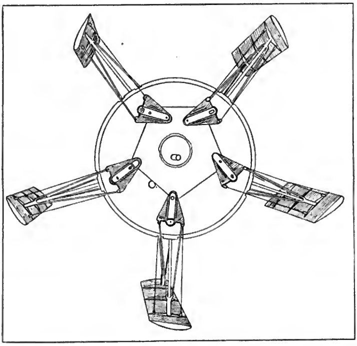
It is well to note, at this point, that every material thing on earth possesses weight—even the thin air about us weighs a definite amount per cubic foot. For example, air weighs 0.07651-pound per cubic foot at sea-level and standard temperature. It is this property of weight, possessed by air, that makes aviation possible since the lift of airplane wings is due to the acceleration of a given weight of air in a downward direction.

And now we will take up a very important matter, the question of FORCE which is the counterpart of weight and which is measured in the same terms by the same units. Weight invariably acts vertically and downwards and can be considered as a force produced by the accelerating properties of gravity. Forces acting in any other direction, horizontally, upwards, etc., are called "forces" although they are identical with weight in every other respect except direction. And, again, artificial forces are often combined with gravitational forces in a downward vertical direction.

It is very difficult to exactly define the word "force" in such a way that it is easily visualized. According to the standard definition found in books on physics, "A force is the physical effect produced by the acceleration of mass." To the beginner, this is absolutely meaningless, so we will be compelled to beat around the bush for a better understanding.

Now, when an object (mass) is started into motion from rest, is brought to rest from a state of motion, or is speeded up or retarded in its rate of motion, a physical something appears that we call a "force."

Likewise, if we start a body into motion or increase its existing speed (acceleration), we must apply "force" by pushing on the body, applying propeller thrust or by some other way. When the body is brought to rest from a condition of motion, the force or opposition must be applied in the opposite direction and the reduction of speed is then known as "negative acceleration" or as "de-acceleration."



All members in aircraft are subjected to complicated stresses but the example above in which centripetal force is encountered, is the ultimate in analytical difficulties.

Propeller thrust (which is a force) when applied to an airplane, brings it up into motion or increases its speed, hence this is positive acceleration, or more commonly, just "acceleration." When brakes are applied, to reduce the speed or to bring the plane to rest, we have a condition of "negative acceleration" or "de-acceleration."

The force applied or resulting from acceleration or de-acceleration is proportional to the change in the rate of motion. Obviously, a greater force must be applied to quickly snatch a body into rapid motion than when the start is made slowly and gradually. Tons of force are required to accelerate a shell up to a velocity of 2,000 feet per second within a small fraction of a second, but only a few pounds are required for starting a book into motion across the table.

Thus, the measure of a force is the acceleration that it produces on a given mass of matter. In short, the force (F) is equal to the product of the acceleration (a) and the mass (m), or: $F = a \times m$.

At the middle latitudes, passing approximately through Washington, D. C., or Greenwich, England, the accelerative force of gravity is equal to 32.16 feet-per-second-per-second in a vacuum. In short, gravity increases the speed of the body constantly (constant acceleration at the rate of 32.16 feet per second for each second that the body falls in a vacuum. This acceleration, due to gravity, is represented universally by the symbol (g). For mid-United States, this can be taken with sufficient accuracy at: $g = 32.16$.

Further south this may be: $g = 32.20$. Somewhat farther north, it may be taken at: $g = 32.12$, but 32.16 is a good average value. From this, it will be seen, that a body falls more rapidly near the equator than it does at the North Pole and that more power will be required for sustaining the load at the equator than at the poles, all other conditions remaining constant. All of these comparisons, of course, are true at sea-level for, as before explained, the gravitational acceleration decreases with the altitude. Mountains also affect the local value of (g) since they increase the height of the earth's effective mass.

But we are now brought face to face with the necessity of converting gravitational acceleration into terms of weight. In all standards of measurement, the weight (W) is equal to the mass divided by the value of (g) as determined in that particular form of measurement. In the English system of measurement, most commonly in use in the United States, the unit of weight (W) is the pound with an average value of $(g) = 32.16$, therefore:

$$W = F = \frac{a \times m}{g} = \frac{a \times m}{32.16}$$

The above equations will be brought into use from time to time so that it will be well for you to give them more than a passing glance. To make the definition complete, we will say that "the MASS (m) is the quantity of matter in question."

Getting right down to the fundamentals of the matter, we can say that the loads and stresses in an airplane structure are caused by or can be attributed to some sort of an acceleration. This may be either the acceleration caused by gravity, by sudden increases or decreases in the speed, or by the downward acceleration of air-masses by the wings. In the end, the action of a force that stresses a wing-beam or fuselage member can always be traced down until we will eventually find that an acceleration is responsible for the load.

(Continued on page 288)

Lubrication and Your Engine

by E. R. SEYMOUR

All about the busy little lubricating oil molecules and the important work that they do in resisting wear and deterioration of the engine parts. So little has been said about lubrication in aviation engines that this article is of importance.

IN the February issue of this magazine I wrote an article entitled "Tuning up the OX5".

Certainly, the avalanche of letters which was received concerning this article can only mean one thing and that is, there are a great number of OX5 engines flying. To those who have written me regarding this tuning up process, I am doing my best to answer your letters individually and will, possibly, at the end of some few weeks, have answered them all.

In writing the article, however, the tuning up process was not finished. Just as important, or I should say more important than all of the additional h.p. and additional r.p.m. is the lubrication problem. I believe I am safe in saying that at least seventy-five percent. of the private operators flying airplanes today, are paying no attention whatever to the lubrication situation except as they see it on the face of the oil gauge.

The average operator of today, when the time arrives for an oil change in his aviation engine, or in other words, when he happens to think about it, taxies up in front of the hangar and yells, "Bill, give her an oil change."

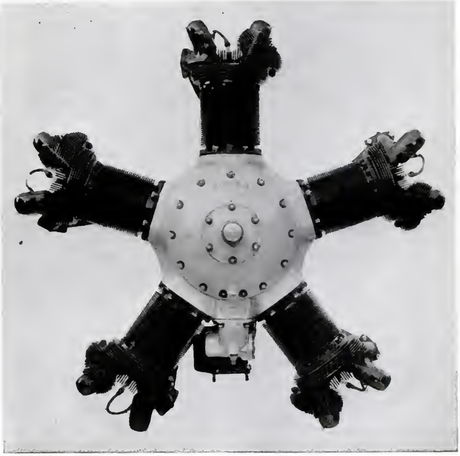
This pilot has no more idea of what Bill puts in the crankcase or oil tanks than a hog has about Sunday. Another bad habit is the attempt to cover up mechanical deficiencies by using heavier grades of oil. The minute a little blue haze appears coming from the exhaust stacks we dive for the heavy oil barrel instead of the parts department.

Heavy oil is like taking dope for a toothache. The pain is still there only you can't feel it. If you read the balance of this article you will get my meaning. Heavy oil does not pass the rings, at least not until the engine is hot. But what is happening while it is getting hot? Some of us get the heavy oil habit so badly that when we do finally replace rings, etc., we think that it worked so well with the old rings it surely ought to be better with the new ones.

The writer has seen many cases where, after a top overhaul, new rings have been installed and fitted, the engine started and ran on an oil far too heavy for that type of engine and, in an amazingly short time the owner finds that these same rings have to be replaced because they have lost their elasticity or have worn thin to the point where they are passing excessive oil. Consequently, the rings take the blame.

I would like to state here that nine times out of ten the same set of rings is as blameless for the condition in your engine as a set located in another county. The blame rests entirely with the operator.

I know of one specific case where an owner spent considerable money installing new rings, valve guides, cleaning up cylinder walls etc. on an OX5 engine. That job flew perfectly for approximately fifteen hours and very suddenly started belching blue smoke from the exhaust stacks.


The hundreds of small moving parts in the aviation engine, each rubbing surface of which requires oil, makes the lubricant and lubricating system the most important elements in the assemblage of the engine.

Upon examination of this engine (and of the operator) I found that No. 70 oil had been used from the start. Consequently, when cool weather arrived, with the necessary choking and priming, the oil that the rings did not scrape off of the cylinder walls was washed off by the raw gas taken into the cylinders in attempting to start the engine.

Due to the extremely high viscosity of the oil, lubrication could not take place for many minutes after this engine was started. Consequently the high frictional heat generated from this condition had turned these rings blue in color.

That operator was fortunate that this had not happened the first hour of flying instead of the fifteenth. Do not try to "get by" without any oil consumption. If this were normal, engine manufacturers would not have to use the term "Oil consumption in pounds per H.P."

In order that we may, with some intelligence, know the grade of oil which we should use in our respective engines, it is necessary that we learn a little about what composes a good oil. I could perhaps write columns and pages and still not describe or specify all the varied and different modes of processing and refining oil. However, we can do this. We can review very briefly the different qualifications which are necessary to make up a good lubricating oil. I think first that we should mention the term with which we are more or less familiar because it is used daily in advertising and in conversational manner. That term is viscosity. Viscosity is a measurement of relative resistance to flow. It is measured in the seconds of time required for a measured quantity of oil at a known temperature to flow (by gravity) through an orifice of special form and size.

The Saybolt Universal Viscosimeter is employed in the United States. Heat will thin out oil, giving it greater fluidity or lower viscosity while cold naturally thickens oil and raises the viscosity accordingly. I am drawing a crude graph which will tend to show you the drop in viscosity with the rise in temperature of two oils from the same refinery, one however being a S.A.E. 20 and the other a S.A.E. 70.

You will note on this graph that as either of the oils approach the crankcase temperature of approximately 260°, the viscosity in seconds also becomes closer affiliated. On the S.A.E. 20 you will note that at 100° it has a viscosity of 600 seconds while the S.A.E. 70 at 100° has a viscosity of 2525 seconds or over four times that of the S.A.E. 20.

While at 210°, the S.A.E. 20 has a viscosity of 53.5 seconds the S.A.E. 70 at 210° has a viscosity of 145 seconds or not quite three times as great. Now it can be seen that should we follow this graph through to 300° the viscosity of the two oils would flow close together. I am bringing this point out for one reason only and that is to show that heavy oils are, insofar as being a means of economy, entirely wrong.

These heavy oils not only refuse to furnish lubrication for the cold engine and hinder in the starting but are not of any greater value than your lighter oils when the engine has reached its maximum temperature. Why then is it not sensible to start the engine out cold on oil which will lubricate from the start and give us the same body of lubrication at maximum crankcase temperatures?

Viscosity, however, although the best known to the layman, is not the only or most important factor which goes to make up a good oil. Along with that, in the modern pressure fed engine today, we must have durability. That quality in an oil which allows it to be exposed to the extreme heat of internal piston heads, to the extreme pressures placed upon it by the bearing surfaces and to high velocity of piston travel and crank shaft speed.

In order that it may retain this quality of durability, this oil must be refined in such a way as to retain those hydrocarbons which compose the highest lubricating qualities and to dismiss the unstable hydrocarbons, sulphur compounds and other chemical impurities.

Another quality which is very necessary to oil, is film strength. Film strength is a characteristic of certain oils which render their film over the cylinder walls, bearing surfaces, etc., exceptionally cohesive, tough and resistant to rupture under heavy pressure. Most mineral oils are compounded of a small proportion of vegetable or animal oil for this particular purpose.

These vegetable and animal oils, commonly termed fixed oils, usually employ rape oil, peanut oil, castor oil, neatsfoot oil, tallow oil, lard oil, sperm oil and fish oils. These oils are usually added to the mineral oil to add to the adhesion and oiliness qualities.

The question will probably arise in your mind how you can determine just which oils on the market contain the qualifications which are set forth in this article. My answer to this of course is that the only way that you can determine the exact ingredients and qualifications of any oil is to have it analyzed. However, as most of you will have neither the time nor the inclination to have your oil analyzed, I believe that you are reasonably safe in buying an oil which is manufactured by most of the nationally advertised oil companies.

However, I would suggest that you buy the best oil which any of these companies refine. There are many oils on the market, with highly colored containers, which are advertised as pure Pennsylvania oils and that can be bought for any price from nine cents a quart up. I believe that you will find that most of these wild cat oils contain very little of the necessary ingredients which go to make up long life and proper performance of your engine.

Another very safe way to buy oil is to adhere strictly to the specifications of your engine manufacturer. If you have not these specifications, write the manufacturer and get them. After all, there is no one in a better position to know the various clearances and internal temperatures of the engine than the manufacturer. Therefore, he should know which grade of oil will meet the requirements of his engine.

In this statement, of course, I refer to the engines of comparatively late manufactured date. With the Curtiss OX5 you will probably find some difficulty in obtaining this information. The writer is fortunate enough, however, to have obtained a specification chart of

(*Concluded on page* 288)

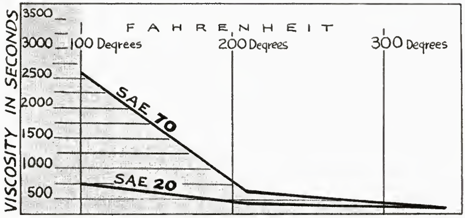
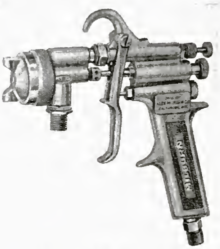


Chart showing the relation between temperature and viscosity. At high temperatures, the viscosity of all lubricating oils becomes nearly equal, hence in duration work, a light oil shows no advantage over the more viscuous oils.

Milburn Type MM Paint Spray Gun



Milburn "MM" Spray Gun.

THE Paint Spray Equipment Division of The Alexander Milburn Co., 1436 W. Baltimore St., Baltimore, Md., announce their entirely new Type MM paint spray gun.

This spray gun is balanced like a pistol. When you point it, you know it is going to shoot a smooth even spray exactly where wanted. Coverage and shape are controlled by merely turning two simple knurled nuts.

Cleaning is only the matter of a few seconds as every part touched by the paint is in the single unit detachable spray head. Entire unit has low center of gravity which makes for perfect balance.

A standard air-hose connection, located at the base of the handle, is designed for ease of handling and to prevent tangling of the air-hose or obstructing adjustment controls. Two-finger grip trigger conforms naturally to the shape of the fingers, responding to the slightest touch. Trigger works against a non-corrosive ball bearing in the end of the air valve stem assuring frictionless operation.

A knurled adjusting nut operates a non-corrosive needle valve to regulate air flow to the atomizer head. This controls the spray volume and the shape of the spray, whether flat or round. Another knurled nut adjusts fluid flow by means of a stainless steel needle valve. This valve is connected by a universal joint for constant alignment and easy, economical replacement of paint needle valve points. The valve is closed by a tension spring which assures perfect seating under high fluid pressures.

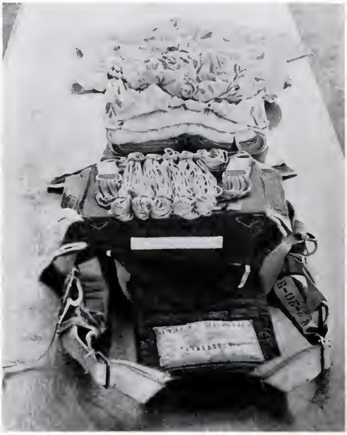
Wingless Model Plane Flies

DETAILS are being carefully guarded concerning a model airplane entirely without wings which is reported to have flown recently in Japan. Developed by Yoshida, the model is reported to have stayed in the air for a period of five minutes. Construction of a full-size plane on the same principle is now under way.

Maintenance of Parachutes

by GEORGE W. de GRANGE

Here are authentic instructions on the care and repair of parachutes. Apparently the simplest of devices, the 'chute requires regular attention in order that it will serve its purpose faithfully. The accompanying photographs were taken with the kind permission of the Commandant, Chanute Field, Army Air Corps Technical School, Rantoul, Ill.



A folded parachute with all parts ready for packing. Taken in the parachute division of the U. S. Army Air Corps Technical School, Chanute Field, Rantoul, Ill.

THE modern parachute is a dependable piece of equipment whose merits have been proven innumerable times.

Few indeed, are cases of failure, yet when they do occur the cause can invariably be traced back to some abuse and ill treatment it has been subjected to at some point of its service.

As its functioning qualities are entirely dependent upon the care it receives, it is at once apparent that proper understanding and treatment can alone win its friendship, while abuse may just as easily result in disaster.

Strength factors, as previously shown, exceed by many times any possible strain that the parachute will ever be called upon to endure. However, despite this fact, a slovenly cared for parachute will deteriorate very rapidly and soon reach a point where it is no longer fit for service.

On the other hand, parachutes eight and ten years old are still in service which have always been given the reasonable amount of care they warrant.

A parachute, whether it is your own personal equipment or one borrowed for a pleasure hop around the field, is your friend just so long as you have it on. It stands ready to meet any emergency. Some time when least expected your life may depend upon it, so treat it accordingly.

Fortunately, the Bureau of Air Commerce will not sanction the repacking and repair of passenger parachutes by personnel other than those specifically licensed for this work by that department.

There are, at present, approximately 375 of these riggers in the United States who have passed rigid examinations in this line and who are fully qualified to service any type of parachute manufactured. If the parachute is maintained periodically by one of these riggers, with no attempt on the part of the owner to make any sort of major adjustment or repair, confidence, in unlimited degrees, can well be placed in the 'chute.

Parachutes are required by the Department of Commerce, when in service, to be repacked and inspected at least every 60 days, or more often if the condition of the equipment warrants it. As no harm can come to the 'chute by testing, this operation is advised at least once a year.

Drop testing will produce and show up any slight defects which might otherwise go unnoticed. Rust and mildew being the principal enemies of the parachute, can, in a very short time, spread with alarming rapidity.

If detected early, preventative steps can be taken and no little amount of expense, for repairs or replacement, be avoided. While the testing operation need not necessarily be conducted by a rigger it will ultimately have to be turned over to him for repacking and as he will no doubt have better facilities for this work it is recommended that he accomplish the entire operation.

Parachute being opened for inspection before being packed at Chanute Field, Rantoul, Ill.

When turned over to a parachute rigger, for its periodic repacking, the chute is unpacked and hung up full length to dry.

That is done in a dry warm room free from strong sunlight, as the actinic rays of the sun are detrimental to the silk. It remains there for at least 12 hours until all moisture leaves the silk. This moisture, a natural condition, has been absorbed while in a packed condition and is not harmful unless left for any length of time. The "airing out" process will fully remove this moisture accumulation.

After drying, the parachute is taken down and stretched out its full length upon a table for that purpose. It is then carefully repacked during which each part is carefully inspected for possible defects which if found and of a minor nature are repaired. In the event they are of major proportions, all riggers are duty bound to refuse servicing until the 'chute has been returned to the factory and the necessary repairs accomplished. Large acid burns and mildewed portions of the silk come under this category.

Packing is accomplished by separating the canopy into its two separate parts with an equal number of panels being, individually, spread down on each side. With both sides laid out in place the canopy takes on the appearance of a giant arrowhead with the shroud lines extending from its center to the harness composing the shaft.

The edges of the canopy are then folded back over and into the center on each side to the width of the pack. From the skirt the canopy is again folded, accordion fashion, into lengths that correspond to the pack's length.

Beginning at the harness, the shroud lines are drawn back and forth between pockets or retainers into which they are stowed. With the entire length of lines in place the folded canopy is placed over them and three sides of the pack drawn up into place.

Into the open end, the carefully folded pilot 'chute is placed and the remaining pack side secured into position. Pack corners are then dressed up neatly and the opening elastics snapped in place. When the rip cord has been sealed, a safe guard against tampering, the 'chute is ready for service. An inspection and repacking data card kept with the 'chute, in a pocket provided for it, bears the date, by whom packed, his license number and the place where packed so that the user can secure this information for the trouble of looking.

Should the parachute be taken from service for an extended period, exceeding 60 days, the owner can, personally, unpack it and beginning at the apex roll the entire unit upon itself. A light sprinkling of naphthalene sprinkled upon the silk itself will do much to guard against moths and mildew and will not damage the material. This must, however, be replenished at intervals as the naphthalene evaporates.

The place of storage should be free from strong sunlight, dry and free of excessive humidity. Should storage be over an extended period the owner can take the 'chute out and hang it up for ventilation for a short period; at the same time looking it over for any signs of deterioration.

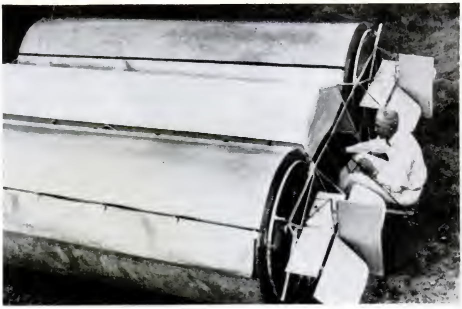
While in service, a few essential rules must be observed which will go far to assure the proper functioning and the normal long life of the equipment.

The 'chute must never be carried by the pack, lift webs or the harness proper. It is relatively easy to break the temporary tacking which hold the various parts of the harness in conformity to the wearer. Also the lift webs, if weight is exerted upon them, may be pulled from the pack necessitating an immediate repacking. Moving or carrying a 'chute should always be accomplished by grasping the short leg straps.

Likewise, parachutes must never be placed in the close proximity of oil or acid, particularly the latter. Acid fumes

(*Concluded on page* 300)

The Radically Different Caldwell Ship



Here we see the Caldwell rotor-craft with its two large rotating cylinders that provide the lifting force. The cabin is carried between the rotors.

WITH a score of new and radical types of airplanes leaving, or attempting to leave the earth, the Bureau of Air Commerce Inspectors and aviation enthusiasts in general have had a hectic time.

The ultimate in radicalism came from College Park, near Maryland University. Jonathan E. Caldwell, inventor extraordinary made public his new "rotor plane." According to him, it will rise and descend vertically, and does not use either propellers or wings.

In an interview with the POPULAR AVIATION correspondent, Caldwell stated that the flying principle upon which his plane operates is entirely different from any in use in air transportation today. "Unlike the modern plane, which operates on the kite principle, my ship works on the principle of bird-flight, a branch of aerodynamics that has been neglected since the Wright Brothers perfected the kite-principle ship," he said.

"In the modern airplane, both lifting and propelling forces are produced mechanically. In bird flight, mechanical force is used for lifting purposes only. Gravitation provides the propelling power."

The plane consists of two long cylinders, longitudinally in opposite directions, and which carry a cylindrical cabin between them. Each cylinder has three vanes running parallel along the sides of the cylinder. These vanes open when at the top of the cylinder to form a wing chamber which deflects the flow of air upward over the plane. The vacuum thus formed is supposed to provide the lifting force.

Propulsion is gained through gravitational force diverted forward by the cylinder surfaces. It is powered with a two-cylinder motorcycle engine.

"Saved by Airship"—An Old Thriller

IN THE old days, anything that flew was an "airship", hence the name of this old melodramatic film produced 'way back in 1912.

The title of this bunch of jumping tintypes was, "Saved by Airship" and the taking was more thrilling than the picture itself. Rodman Law, brother of Ruth Law, jumped from the front porch of the Model "B" Wright into the East River to rescue the heroine—and this was before the days of parachutes. He was entirely chuteless as one might say.

But, the fact that the old Model "B" rambled along at a top speed of 40 m.p.h. made it possible to jump overboard with comparative safety. What really contributed the thrills and goose-pimples was the fact that the heroine got all gaflumoxed at the last moment and leaped from the row-boat at the wrong time and in the wrong place. This put the villain to the necessity of carrying the rescue work out by himself because Rodman had all the wind knocked out from him by the jump and couldn't swim. Ah me! Them were the days!

The Model "B" was flown by "Aviator Leo Stevens" who generally had his hands pretty full of control levers. Stevens in his time (1909-1915), was as famous as Colonel Roscoe Turner is today. The barnstormers, and Leo among them, made plenty of money prior to the Big War. The regular compensation was $1.00 per minute in the air. The difficulty, however, was to stay in the air more than one minute. There's always a drawback of some kind! Ain't it the truth?

Painting and Doping Your Ship

by F. E. NAGLE

Some important and useful instructions on the maintenance of the lightplane that will increase the life and improve the service that can be expected of it. Painting and doping are not so very expensive and do serve a useful purpose.

Fabric needs constant attention. Inspect the wing covering frequently, touching up scarred surfaces, scratches and loose patches.

A WELL built ship is worth a good paint job, both inside and out, and good protective coatings will increase the life of the ship manyfold. Good paint jobs, as well as careful flying, make your ship last long and give you your return on your investment.

For simplicity and clarity, it may be well to take up the matter of finishing the various components in their order of construction, and therefore they will be taken up in this order. The main divisions consist of metal, wood and fabric and under these come steel-tubing and fittings, aluminum or alloy parts and various other metal components. Under woodwork comes the finishing of plain wood, plywood and composite structures. For fabric we have numerous methods employed to gain various styles of finish.

Taking up the matter of metal work, we might start with the finishing of the fuselage structure. Say that it is a welded structure of conventional design. While under construction you should see that small holes of about three thirty-seconds or one-eighth of an inch in diameter are drilled in the longeron wherever the struts are welded on.

They should be about in the center of the circle made by the tube to be welded on, and care should be taken that one is drilled wherever a tube strut is positioned. You can now see that the holes make a sort of pipe-line system of the whole structure. In the top and bottom longerons, after all the welding has been completed, drill the same size hole, both at the firewall position and near the rudder-post.

Now, secure about two gallons of Lionoil. This is similar to a varnish but much more flexible and elastic after drying. Stand the fuselage up on the tailpost and pour the Lionoil into the holes drilled at the forward end, after sticking wooden plugs in the holes at the tailpost. You will need a funnel with a very small nozzle, or an oil gun with the same size nozzle to get the Lionoil in the tubing without spilling most of it.

You will find that the average fuselage will take the whole two gallons of Lionoil, provided it is up on end, and all the tubes have been connected by holes. After all the Lionoil has been poured in, plug up the forward holes and keep twisting the structure around and around. This will insure Lionoil reaching all the interior surfaces of the tubing.

Let the Lionoil stay in the structure for a day, during which time it has been revolved frequently. Now, stand the structure up on the tailpost, and put a can under each of the holes that were drilled. Pull out all the plugs, front and rear, and let the Lionoil flow out. You can get it to flow out faster by plugging all but one of the top holes, and forcing compressed air into the structure.

Poke a wire through the bottom holes occasionally, to remove any scale that tends to obstruct the flow of the Lionoil. After the Lionoil has stopped flowing, plug up the holes with brass drive screws, or solder. You can use the Lionoil later on for the wing woodwork and other purposes, if you strain it through a cloth to remove sediment. Keep it in a closed can.

Now we come to the matter of painting the outside of the fuselage structure. The above mentioned process will protect the interior of the structure from rust, and now we have the outside to deal with.

First, the entire outside of the structure should receive a roughing up with coarse sandpaper, emery cloth or a wire brush. Remove all scale from the tubing and have everything show a smooth bright surface. Now, put on a pair of rubber gloves and wash the tubing with Deoxidine or some other chemical of the same nature.

Be sure to wash off all Deoxidine with hot water, using a hose if possible. DO NOT, and this is important, touch the structure with ungloved hands after cleaning the metalwork with Deoxidine, high test gasoline, thinner or similar grease dissolving fluids.

If you cannot obtain Deoxidine, high-test gas or thinner can be used to clean the structure, but these are not as good, for Deoxidine neutralizes all alkali and acids present in the metal, thus giving a chemically pure and clean surface.

Immediately after cleaning the metalwork on the fuselage, the painting should be started. Do not allow anybody to touch it with their bare hands, for by so doing, they will deposit a film of grease and moisture upon which the paint will not take hold properly. This will sooner or later destroy the paint film at this point. This is very important if you want a perfect paint job.

Lionoil is excellent for a first coat on the fuselage tubing, and this may be either clear or mixed with aluminum powder. Aluminum Lionoil will protect the tubing better than clear, and this should be mixed about twelve ounces of powder to the gallon of clear fluid. Brush or spray on, using naphtha or high test gas for thinning. Be sure to cover the entire surface of the tubing on the first coat, and allow it to dry at least twenty-four hours under average temperature conditions. Lionoil has a habit of drying hard on the outside while still being soft underneath, so twenty-four hours is not too long for a drying period.

When the first coat has dried thoroughly, the second coat of aluminum Lionoil may be brushed on. See that the painting is done systematically so there will be no bare, dry areas. Let this coat dry twenty-four hours. Some ships are covered in a manner that the fabric lies against the bottom of the lower longerons, and this is a frequent cause of rusted metalwork at this point.

If at all possible, you should run a

wooden-strip along the bottom edge of the lower longeron to keep the fabric away from it. It seems that, in jobs where the fabric is permitted to lie against the longeron, the dope will soften the Lionoil or other oil base finishes beneath, causing them to lift and thus leaving no paint at this point. If you do not desire to run such a strip along at this point, it will pay to tape the longeron after the last coat of paint, with adhesive or friction tape.

Tape close, so there will be no places for the moisture to collect. If your ship is to be used on water, it is a good plan to paint the lower longerons and struts with bitumastic paint, and tape while the paint is still wet.

Some prefer wrapping in aluminum foil, instead of using tape, but this method is used chiefly by the Navy. Run a strip of tape over any surfaces that are touched by the fabric, to prevent the dope lifting the paint. This completes the painting of the fuselage, and it should be needless to state that no welding should be done after it has been painted. This burns off the Lionoil on the inside of the tubing.

It should be remembered that oil-base finishes should be used exclusively for priming-coats or first-coats on any kind of metalwork. Pyroxilin finishes have absolutely no protective value and therefore lacquer or pigmented dope should not be used for a first coat on bare metal. A suitable metal oil-base primer or paint should be first applied and then the finish coat of enamel or lacquer.

Do not brush lacquer or other pyroxilin finishes over an oil-base paint for the paint will lift, making the surface look like the surface of a rubber sponge, both destroying the appearance and the protective qualities of the finish. Use a spray-gun when a pyroxilin fluid is to be applied over an oil-base primer, and fog on the first coat or two, to prevent lifting.

The above methods apply for all the other metalwork, such as struts, fittings, cowling, etc. Clean first with deoxidine or other cleaner and then prime with an oil-base paint. Do not touch the metal with the bare hands from the time it is cleaned, till after the priming coat has dried. Enamel applied over a suitable primer, either by spray or brush, makes a superior finish to pigmented dope or lacquer, for use on metal. If you have no spray outfit enamel will be the best final finish you can use for the struts and cowling.

When enameling, there are a number of precautions to observe. First the temperature should be around 70° F. or over. Then, the room should be absolutely clean and free from dust. Don't wear sweaters or other linty garments. Wet down the floor and see that the surface to be enameled is ready.

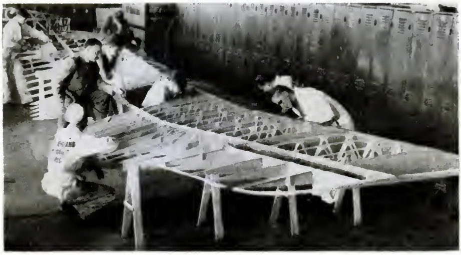
Do all sanding and wiping outside. Use a fairly soft brush, and brush out the enamel, until all possibility of runs or streaks has been eliminated. Lay the object so the painted surface is horizontal or nearly so. And, finally, go by the directions on the can if you want the job to turn out one hundred per cent perfect.

Nothing looks worse than an enamel job that shows runs, or has dried full of lint or dust and nothing looks better than a good enamel job with its authentic shine and mirror-like surface. Do not forget to use the proper undercoat, for bright colors. To make reds or other such colors stand out, use an undercoat of light gray or dark yellow.

If you prefer a pigmented dope or lacquer finish for struts or cowls, the first thing to do is to clean the metal. Then apply with a gun, a good priming coat of an oil-base primer. Allow this to dry thoroughly and then sand lightly to remove any roughness of the surface. Now, with the proper color of lacquer or pigmented dope (one manufacturer puts out a pigmented dope that works as well on metal as fabric) in the gun, properly reduced, spray on a light cross-coat. If this first coat is too heavy, or very thin, the primer may lift, therefore a light coat is best.

Follow, when dry, with another light cross-coat and allow it to dry for an hour or so. Then sand, with 280 C wet or dry water sandpaper, lightly, or use fine ordinary sandpaper. Now you can spray on the two finishing coats, fairly wet, and cross-sprayed, sanding lightly before the last coat. This will produce a glossy durable finish upon which a high luster can be obtained by rubbing down with rubbing compound.

A careful inspection must be made at every point.



The wing plane requires particularly careful protection against moisture.

Don't forget that the inside of the struts should also have a coat of Lionoil applied by plugging up one end of the strut, pouring in the Lionoil, plugging the other end and then shaking around to get a coat over the entire inside. Then let the Lionoil drain out and strain for future use. If your ship makes use of wires for the external rigging, they should be boiled in linseed oil preparatory to painting if the cable type, and painted with aluminum varnish or Lionoil if of the streamline variety.

Some streamline wires are cadmium plated, in fact most of them are plated at present, but replating a set of wires for the average ship, at a plating shop, will usually cost around ten dollars, which is very much more than the cost of a coat of paint, even though it does last much longer.

Lately, a lot of home builders have been building metal floats for their ships. Metal floats, either of dural or aluminum, have to be painted properly if you expect them to stand up on salt water operation. Fresh water is not very tough on aluminum or dural, but floats for fresh water operation should receive the same attention as those intended for salt-water use.

And while we are talking about the floats, we must also take into account the fact that it is well to protect all of the aluminum and dural fittings as well as the floats for salt water spray is very penetrating and may affect aluminum engine fittings and instrument parts as well as the floats.

First off, you should obtain about a gallon of bitumastic paint, which somewhat resembles liquid tar, and smells worse than——, well it need not be printed. Paint the interior of the floats with this paint, before the bottoms are riveted on and be absolutely sure that there are no unpainted surfaces. Apply

(*Concluded on page* 286)

Letters From Our Readers

We have picked, at random, a few commentaries by our readers which will afford material for reflection. Our correspondents' views are frequently both entertaining and educational.

WE are particularly pleased with this month's crop of letters which are more than usually interesting and newsy. They cover many subjects and view matters from many different angles, so that we are ensured of a great variety of material that is obtainable in no other way.

Taking the first letter off the pile, we find that it is from C. J. Boyd, Amarillo, Texas, who had direct contact with the NC-4 which made the first ocean crossing. It is always very fine to contact men who have participated in historic events and we thank Mr. Boyd for his kind article.

* * *

In the January issue of POPULAR AVIATION magazine I read your article on The First Atlantic Crossing and can say it is the best article I have ever seen of its kind and agree with you in every way.

You are correct about Commander A. C. Read and the old NC-4. They crossed the Atlantic in May, 1919, with Lieut. Walter Hinton and Lieut. E. S. Stone as pilots, Lieut. J. L. Breeze as reserve pilot and engineer, and Ensign H. C. Rodd as radio operator, and a Chief Mech. Mate E. S. Rhodes; being the first men to cross the Atlantic Ocean successfully.

I was a first-class mech's mate in the U. S. Naval Aviation during the war, was transferred to the N. C. Service in February, 1919, and sent to Rockaway Beach to help assemble and test the NC planes and motors. There were four planes built, NC 1, 2, 3 and 4. When the planes were ready for the flight, fifteen other airplane mechanics and myself, were transfered to the mother ship USS Arostook and sent to Trepassey Bay, Newfoundland, with supplies, motors, oil, linen and parts with ten thousand gallons of gas in two railroad tanks on rear of the ship.

When the NC 1, 3 and 4 came in, three days apart, the aviation crew was put to work on the NC 1 and worked continuously for this length of time, day and night, to make ready for them to get on their way to the Azores before Brown and Alcock got away from St. Johns, Newfoundland, if they had not had some hard luck they would have been first to cross. After the planes left for the Azores, the Arostook left for Plymouth, England, where we waited for the planes to come in. The NC-4 was the only one to make the trip out of the three that started.

Powel Crosley, Jr., America's premier private aviation enthusiast who owns four planes and several private airports. He is seen here with his Northrup.

The NC-4 rested in Plymouth Harbor for some time, and then the aviation crew from the Arostook dissembled her and put aboard the Arostook and brought her back to the U.S.A. She was unloaded on a barge in Hoboken and they took her to 69th St. and Central Park, where she was assembled in Sheep Meadow for the public to see. The small crew of men, for thirty days, guarded and explained the trip and plane as well as passed out pamphlets to the public. During this time, the R34 crossed the Atlantic and flew over New York, We dissembled the plane and took her back to Rockaway Beach where she had started months before. We were the only men left in the NC service from nearly a thousand men.

Credit has always been given to the men who fly the trip and they are the ones who get the glory and riches, but what has ever been thought of or said about the men who make this possible by their hard labor, skill and knowledge. Without men of this latter class it would be hard for any pilot to have success crossing any pond in a plane.

The United States Government has never given the men who made this flight possible, a letter or a medal of any kind to identify their services in this flight. I have an honorable discharge showing where I served but no credit for the flight. Men have to be trained to fly and some are better than others. They give the best of flyers the glory because they are capable of doing things right. Men also have to be trained as mechanics and I think that they should receive credit when it is due them.

You say that the public soon forgets the pioneers. They are not the only ones who forget as soon as they get what they want from you. I have hoped for some time someone would write an article such as you have. I appreciate this one of yours and I am going to keep it. I have never been able to see why some people should give so much glory and credit to one person and then pass up another who has done as much or more.

If you want any more information concerning my services, or about the NC planes and flight, I have plenty. I am enclosing a pamphlet we passed out to the public for thirty days.

My mechanic's Department of Commerce license is still in effect and has been for years but have been out of the game for nearly four years. I have never been responsible for anyone getting into trouble with an airplane and will not do things that are going to lead to trouble sooner or later.

A line-up of real wartime planes in the Jarrett collection.

* * *

FLOYD HASSELL, Bellport, N. Y., has a brand new idea on the lightplane situation if a brand new idea is possible on this subject. At least, it is original with *him although it is likely that certain others may claim priority and walk off with the patent.*

* * *

I believe I have a plan that will stimulate interest in aviation. It will end the feud between prospective builders of light planes and gliders and the D. of C., it will mean a good increase in the sale of aviation materials, it will give employment to a few experienced aviation persons and it will give us fellows that are itching to do something a chance to do it.

The D. of C. could design three gliders (one of each type), and sell these approved designs at cost. Also, design one lightplane and sell the plans of it at cost. The designers would bear in mind that these aircraft are to be built by persons with a minimum of equipment. Therefore, they would have as high a factor of safety as possible without being too cumbersome. This would allow for crude construction due to lack of facilities for doing fine work.

Then aircraft would not have to be made under the supervision of a licensed mechanic, but, the D. of C. could strongly advise the builders to have an expert as an adviser. Before the aircraft was covered, the D. of C. inspector would carefully inspect the aircraft to see that it was constructed according to specifications.

Then, after it was covered and ready to be test flown, the inspector would observe the test flight, inspect the covering and approve the aircraft. At the same time he could observe a flight by all of those intending to fly the glider (this is for gliders only) and if in his opinion they were competent, he would issue a pilot's license.

He could give them an oral exam on the principles of flight, too. The prospective pilots could be made to undergo a physical exam by their family physician to see if they had any defects such as heart ailments, very poor eyesight, and other serious disorders.

* * *

AND now we have the lament of Al Mifian (no address) who believes that facilities should be given to model builders for testing their models in large cities where open fields are few and far between. We think that this is a fine idea and we only hope that this scheme works out.

As a last resort, I've decided to write you to see if something can be done toward helping the model builders gain entrance into the local armories in order to test and fly their models.

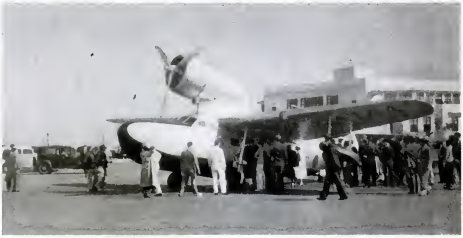
For years, we have frequently attempted to persuade the caretakers of some of these armories to permit us the use of these places at times when they weren't occupied (and you know that they lay idle a great percentage of the time), but no, the answer was always, "We can't let you fellows in—you'll have to see so-and-so," or "Write to so-and-so"

I fully realize the fact that permission is sometimes granted for the purpose of holding "meets," but goodness knows the "fight" behind the efforts to obtain privilege.

In European countries, they advocate aviation for their youths and even go as far as to sponsor a great many facilities for the advancement of aviation. The least

(*Concluded on page* 290)

The Fairchild Type 91 Amphibian



A three-quarters front view of the new Type 91 Fairchild Amphibian which is designed for service on Pan American Airways.

THE first Fairchild 91, world's fastest and largest single-engine amphibian transport, was delivered to Pan American Airways System.

This first "Baby Clipper," also called the "Jungle Clipper," is powered with a Pratt & Whitney Hornet of 750 horsepower. A second ship powered with a Wright Cyclone of 760 horsepower is to be delivered to Pan American soon for use on the Yangtze River in China.

The machine is being put through the System's routine inspection and test flights for all new craft at the Miami base. It will be used on the 1,000-mile Amazon River run between Para and Manaos, reducing the time for this run from 10 to 6½ hours. This will put Manaos within four days travel by air from New York City. The amphibian was designed by Fairchild engineers, in cooperation with Pan American engineers, specifically to meet the operating requirements existing on Pan American's river and coastal routes in South America and China.

On the flight to Miami, Pilot Harold E. Gray and co-pilot Gerald Fisher of Pan American Airways, were in charge. Passengers were W. H. Schwebel, vice-president of Fairchild Aircraft Corporation and J. Blumenthal, a factory man.

The Fairchild amphibian has a useful load of about 40 per cent of its gross weight, a specially interesting figure in view of its high performance and amphibian characteristics. The cruising speed ranges from 140 miles per hour at sea level at two-thirds horsepower to 162 m.p.h. at 16,000 feet.

Try These When You Are Blue

THERE is a popular song that contains the line: "It may sound crazy". And, of course, the implication is that whatever the singer is saying is true despite its seeming insanity.

In like manner, I remark that it "may sound crazy" to state that a man can be *steady* and *flighty* at the same time. But it is true. Let's see how it works out. If he's reliable, he's steady. If he's a pilot, he's subject to flights and therefore flighty. Then, if a man is a reliable aviator, he is both steady and flighty.

Speaking of the word "steady" reminds me that a friend of mine has a steady job. He is one of a troupe of flying acrobats, and his part of the work is to walk out on the wing of a plane in midair and step to the wing of another plane flying alongside. He says the work is very steady.

I asked him one day if he didn't ever get "rattled" when flying, and his reply was that Henry didn't make engines for airplanes.

Even so, airplane motors make plenty of noise. So much so, in fact, that when an aviator friend of mine (another fellow, this time) got married, he told me he didn't miss hearing his own voice; he'd been flying so long behind a big airplane motor anyway.

An airplane engine is a complicated affair. Personally, I wouldn't have the least idea how to put one together or to take one apart. But I am not a student of those things, like a lad I heard of who was flying with an instructor seated alongside him.

"Now," said the instructor, "you'd better open up the throttle."

"But," protested the student flyer, "don't you think we'd better wait until we land to take the engine apart?"

This same student flyer was standing, one day, directly in the path of the exhaust from an airplane motor. He complained that the engine had a bad case of halitosis.

The day hasn't come yet when everybody owns a plane, but private ownership of pleasure craft as distinguished from commercial proprietorship is fairly common. There was a man who owned a plane, and loaned it to a friend.

This friend had a bad crash, and ever

(*Continued on page* 280)

Kinner Produces a Transport

One of the most interesting commercial planes placed on the market within the last few months is the Kinner "Invader" which has shown a remarkable performance on its test flights.

THIS twin-engined Kinner low-wing cabin transport plane is the latest addition to the Kinner line. It is a small passenger ship with a total of 740 horsepower for both engines, but it is exceedingly fast and withal, a most desirable intermediate type that should meet with ready acceptance.

The Kinner "Invader", a new twin-engined, low-wing cantilever commercial transport plane with six to eight places provided for pilot and passengers.

MOST interesting is the announcement that the Kinner Airplane & Motor Corporation has produced a commercial transport plane, for hitherto, Kinner has itself confined largely to the production of planes designed for private ownership and the sportsman pilot. The new transport is known as the "Invader".

While the standard Invader is a six-place ship, yet it may also be equipped as an eight-place job, the latter adding about 100 pounds to the empty weight. With a pilot, seven passengers, 216 gallons of gasoline and 240 pounds of baggage, the Invader will have a cruising range of 850 miles. With a pilot and five passengers, this radius is increased to 900 miles, all of these figures being based upon a 75-percent. open throttle. Cruising at 65-percent. power, the range will be increased by approximately 10-percent.

One feature is the roominess of the cabin, a seat spacing of 42 inches being possible with the middle chairs brought face to face with the rear chairs. The cabin is completely soundproofed and provided with a ventilating system and heater. Both the pilot seats are adjustable. The passenger seats have adjustable backs.

Dual controls are provided with two control columns placed side-by-side in the forward part of the cabin, so arranged that the right-hand control column is easily removable. The engine, flap and landing-gear controls have been so arranged that they may be operated by either pilot or co-pilot with a minimum of effort, with indicators visible to both pilots.

Two emergency exits are provided in the cabin, both of which are sealed against sound, air and temperature when closed. The lavatory is in the rear of the cabin while a large baggage compartment at the rear of the cabin holds two Pullman wardrobe trunks and three suit cases. This compartment is accessible from the cabin while shelves in the cabin provide for additional hand luggage. Space for the radio equipment is also provided and the entire plane is shielded and bonded for this purpose.

WINGS

One piece cantilever. Laminated spruce box spars, plywood covered. All ball bearing Frise type (differential control) ailerons, statically balanced; irreversible tab on left aileron adjustable in flight. Dural, tapered, split flap extending under lower surface of fuselage, hydraulically operated.

FUSELAGE

Welded chrome molybdenum steel tube, covered with fabric, fin integral with fuselage, to increase rigidity.

TAIL UNIT

Welded chrome molybdenum steel tube, fabric and metal covered, cantilever fin and stabilizer. Irreversible tabs on rudder and elevators, adjustable in air. Rudder and elevator statically and dynamically balanced.

LANDING GEAR

Streamline landing wheels, retractable into engine nacelles. Hydraulic brakes. Streamline tail wheel mounted in cradle with oleo and spring shock absorber. Full swiveling and locking.

The landing gear is so designed that in event of complete failure of operating mechanism it will lower by its own weight to a locked position. The center of gravity travel is but three-tenths inches between the up and down positions of the landing gear, which obviates the necessity of re-trimming the ship when gear is lowered.

POWER PLANT

Two supercharged seven-cylinder, radial Kinner C-7 engines developing 370 h.p. at 1900 r.p.m., blower ratio 9.70, supercharged to 5,000 feet. General Electric supercharger. Hamilton Standard controllable pitch propellers.

Fuel carried in wings, oil in nacelles. Maximum gasoline capacity 360 gallons. Engines supported on wing by steel tube mounts, mounted on Lord anti-vibration bushings. Floor is so mounted as to minimize transfer of vibration from engines to passengers.

A study of the accompanying specifications will show that this pocket-size airliner contains all of the most modern developments and accessories now employed on transport planes, and in addition to its airline function should prove to be a desirable type for charter work or for corporation exploration.

The useful load is approximately 60-percent. of the empty weight while the payload is about 25-percent. of the empty weight. The cruising speed of 190 m.p.h., attained with a total of 555 horsepower (75-percent. throttle) is maintained with an expenditure of 49.5 gallons of gasoline per hour.

PERFORMANCE

Maximum speed—level flight	210 m.p.h.
Altitude for maximum speed	5,000 ft.
Landing speed—power off, full load	63 m.p.h.
Rate of climb, full power, full load	1,255 f.p.m.
Rate of climb, one engine dead, full load	180 f.p.m.
Cruising power @ 75% power	555 h.p.
Fuel consumption @ 75% power	49.5 gal. pr. hr.
Cruising speed @ 5,000 ft. @ 75% power	190 m.p.h.
Cruising speed @ 5,000 ft. @ 65% power	180 m.p.h.
Ceiling with one engine dead, full load	6,500 ft.
Service ceiling, full load	20,000 ft.

WEIGHTS AND LOADING

Gross	8500 lbs.
Empty	5320 lbs.
Useful load	3180 lbs.
Pay load	1390 lbs.
Power loading	11.5 lbs./BHP
Wing loading	21.4 lbs./sq. ft.

An Airway Incident
by JANE MEYERS

"PINT SIZE" Ralph Virden of United Air Lines holds the enviable safety record of never having scratched so much as a wing-tip in over a million miles of flying.

Several years ago, before the installation of the directive radio beam, Virden was flying passengers along the west coast in a tri-motored transport plane. He was on his regular scheduled flight and, seeing threatening weather ahead, he decided to land his passengers at an intermediate field and "train" them. The field that Virden had chosen to sit down in rested at the base of some mountains 1500 feet high. He and the crew had been sitting around for a couple of hours, when it appeared that the weather was clearing and they decided to go "upstairs" and look around. They boarded the transport and flew to 1,000 feet when suddenly visibility became zero-zero and they were "blind."

What to do? Virden hesitated to try and get back because of the proximity of the mountains; the only thing left was to go higher. He spiraled to 17,000 feet, and soon was high above the bad weather. It was a phantom sight that greeted the airmen. The moonlight was bright, and shed its radiance over a strange level sea of vari-formed clouds. But he was completely cut off from the ground, and he decided to call Oakland on the radio.

"Pilot Virden calling Oakland, Pilot Virden calling Oakland, advise ceiling and visibility at Oakland. Flying 17,000 feet approximate position above Burbank."

The radio operator's voice barked in his earphones.

"Special, Special Oakland to Pilot Virden, Oakland to Pilot Virden, ceiling at Oakland 2,000 feet, visibility 4 miles."

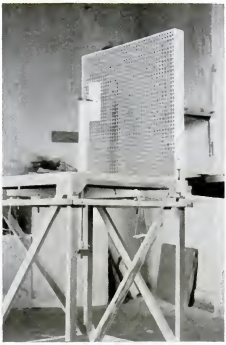
That seemed all right. He headed his plane south on a compass course to Oakland, estimated the wind drift and flew steadily for three hours. Surely they must be over the great flat sea level of the Sacramento Valley.

They were still flying on top of unbroken clouds, and because the radio beam had not been developed Virden preferred to come down through a hole rather than to fly blind through solid clouds. His gasoline was getting very low when suddenly he spotted a hole and spiraled down to emerge directly over a lighted intermediate landing field.

"Hey, where am I?" he called to the field attendants who came running to greet him. "In the Sierra-Nevada mountains, 150 miles east of Oakland." A cross wind of unusual velocity had swept him off his course. Today, with the directive radio beam, such an incident is impossible on the air-ways.

There is hardly a doubt but what radio and radio appliances have developed more rapidly than aviation, because such advances that have been made recently are largely electrical.

Notes for Home Wind-Tunnel Operators
by RAOUL J. HOFFMAN



In this view, the model is in a vertical position as in Fig. 1.

The model is now placed in a horizontal position as in Fig. 2.

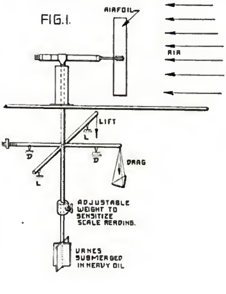
THE amateur experimenter meets with many difficulties in designing a simple contrivance for determining the center of pressure.

The well-known wire suspension of the airfoil is too tedious for small wind-tunnels and it seems that the N.P.L. method of supporting the airfoil by a spindle is the easiest to test with.

In our pictures and sketches, we are showing an improved arrangement for finding the center of pressure by rotating the airfoil around its horizontal axis. Fig. 1 shows the method of finding the lift and the drag of an airfoil held at its center. By releasing the supports L-L we measure the lift and by releasing the supports D-D we measure the drag of the airfoil.

We then rotate the airfoil 90-degrees around its horizontal axis and measure the torque on the drag scale. From the lift and drag we obtain the magnitude of the resulting force. Dividing the torque by the resulting force gives us the distance of the resultant from the points L-L. Then, we obtain the center of pressure by the graphic method, which is simpler than the mathematical one.

FIG. I.

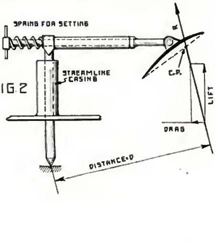

AIRFOIL
AIR
LIFT
L
D
D
DRAG
L
ADJUSTABLE WEIGHT TO SENSITIZE SCALE READING.
VANES SUBMERGED IN HEAVY OIL

A flat plate is attached to the spindle, perpendicular to the airflow. Knowing the drag coefficient we can now determine the actual air-speed.

As the forces encountered are very small, the weight and dimensional measurements should be made as accurately as possible, checking them with the balances used by your local druggist or high-school laboratory as possible. Again, the lever-arm lengths require accurate measurement with a machinist's steel scale. The results obtained are only as accurate as the means employed for measuring them.

The honeycomb shown here for straightening out the air current is another point requiring careful adjustment, for any torque measurements taken with a swirling current will be greatly in error.

FIG. 2



What Our Readers Are Building

Snapshots and descriptions of lightplanes, engines and gliders will be found here that prove the ability and ingenuity of our readers. Every job shown here is an amateur job of which we are very proud.

OUR home-builders are coming in fast and furious once more. We have received more photographs of hand-carved lightplanes during the past two months than during the preceding year, and it looks as though prosperity had at last turned the historic corner.

First, we have the nice looking parasol monoplane built by Edgar Smith, Jr., Fallon, Nevada, which he describes as a 2-place Heath somewhat revamped and modified by himself and partner, Forest Taylor. Two years of spare time completed the job with numerous revisions in the way of a stronger landing-gear, stronger tail, balanced rudder, etc.

It is now equipped with a 90 H.P. LeBlonde engine which gives it a top speed of 125 m.p.h. and a take-off within 3½ seconds. The landing speed is about 40 m.p.h.

And we're glad to have Gene Kimbell, Box 34, Dimmitt, Texas, back with us after a considerable absence. His ship appeared in its semi-finished condition in a past issue, made ready to take a Ford engine, but as shown in final form it is equipped with a Velie M-5. It is not an Air-Camper but is along similar lines, about 10-percent. larger and built much heavier.

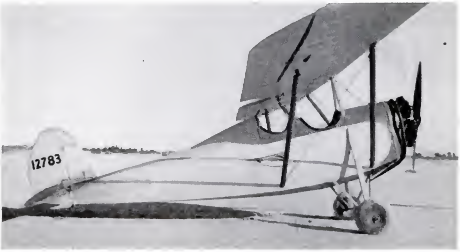
Gene has not spared the horses with this ship, but has given her some hard usage. Last summer he flew it over mountain ranges in Colorado and New Mexico, and there's not a scratch on her. He would like to trade photographs with other home-builders and amateurs. We are certainly glad to hear from you, Gene, and when you have any news, send it in.

And next, are some shots of a fine ship built and designed by Charles H. Brown, Brown Machine Works, E. Third and Main streets, New Albany, Ind. It has been flown a total of well over 100 hours and has a consistently good performance record for a period of over two years. The Heath-Henderson converted engine is hopped up with 30 degree valves, an Eisemann magneto and a big Zenith carbureter, all of which bring the performance up to an unusual degree. By special development of the propeller it has been possible to attain an altitude of 4,000 feet in spite of the fact that the gross weight of the ship is 650 pounds.

The fuselage is of welded steel tubing, Warren strut construction and air-oil shock struts are equipped, which with the air-wheels, make safe landings possible in rough places. It is not a spectacular performer, according to its builder, but for all around sportplane service it has proved entirely satisfactory. It is very economical and easy to maintain.

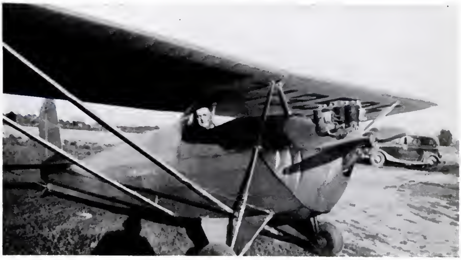
Wing span	26'—0"
Chord	63"
Overall length	18'—0"
Top speed	65 m.p.h.

Just Look Them Over and See Real Jobs



Edgar Smith built this neat looking job, a 2-place Heath equipped with a 90 h.p. LeBlonde engine.

And now we have the Gene Kimbell job which has been described in these columns before but with another engine.



Last, but not least, we have the Indiana plane built by Charles Brown, New Albany, Ind.

One Exception to Dog Rules

PIGS may be pigs but dogs aren't dogs, Captain William Austin, vice-president of Pennsylvania Air Lines has ruled. At least "seeing-eye dogs" aren't dogs.

There is a long established airline regulation that no dogs may travel on the regular transport planes.

But recently, Robert Gay, a student of sociology at the University of Pittsburgh, who has been blind for years, announced that he wished to take a trip over the line to Detroit. And everywhere that Gay goes, his three-year-old shepherd dog, Fifi, called a "seeing-eye" dog goes too. Without her Gay would be helpless.

So Austin made a new rule—that "seeing-eye" dogs since they serve as eyes for their masters, aren't really dogs at all when they travel the airlines. And Gay and Fifi started off for their first trip in the air.

At first, Fifi acted slightly nervous, as the big plane taxied across the airport and took off. She stood by her master's seat, ears erect, apparently keyed up and ready to spring if necessary. Born in Switzerland, of a famous breed of dogs, and highly trained and sensitive to the slightest noises or scent, she apparently realized this was a new realm through which she was traveling.

As the plane rose higher, she began to pant a little, her tongue hanging out, as if she had been running. "It may be that she is trying to counteract the strange feeling in her ears that way," suggested Gay, who was beginning to feel the pressure on his own ears, he said.

Finally, however, with the firm touch of her master's reassuring hand on her back, the brown-eyed dog settled down on her haunches, keeping a watchful eye on the other passengers, however.

Gay was meanwhile exploring the plane himself in a blind man's way, and discovered the cigarette lighter, the ash tray, the call button for the co-pilot and even the ventilation system.

"This is the finest way a blind person can travel," he said. "It is much better than trains because there is less confusion and fewer people walking around. Is the moon out?" he asked again, eagerly.

"Feel Fifi's back now," he went on. "A dog's nerves are mostly in its back. See, she is quieting down."

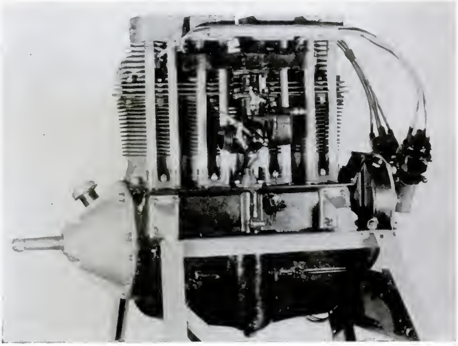
It is true, the anxious quivers which had been going up and down the dog's spine, had ceased.

Again Gay asked, "Are the floodlights on as we approach the airports?"

When the plane arrived over Pittsburgh, their home town, and the inevitable smell of smoke from the blast furnaces rose to the travelers, Fifi seemed to know that she was over familiar ground.

She rose to her feet and pulled anxiously on the special harness which had been constructed for her to lead her blind master around.

The Interesting Douglas Aircooled Ford "A"



Carbureter side of the Douglas aircooled converted Ford "A" engine.

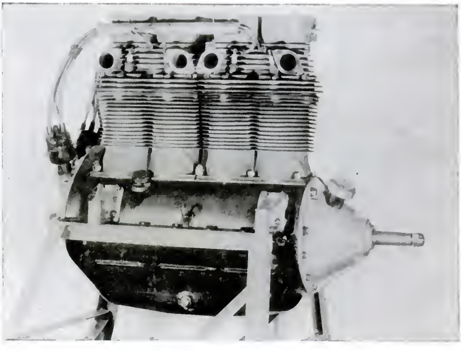
THE Model "A" Ford motor, recognized for its ruggedness, simplicity and economical operation, is also looked upon as the last word in an aircraft engine by the home-builder.

In the past year, the Model A has been further developed into a modern air-cooled engine. To do this, it was necessary to remove the water-cooled cylinders and attach air-cooled cylinders with air-cooled aluminum alloy heads. The heads and cylinders have been designed for standard Model A parts, connecting rods, piston, valves, etc., which eliminate costly replacements.

Some small changes have been made in the oiling system. It is now known as a semi-pressure system with pump pressure to the mains and surplus to the oil-pan trough for the connecting rods.

A special steel alloy propeller shaft extension has been used which is supported by a large thrust bearing through a strong aluminum housing bolted to the motor. The design of the cylinder head permits the use of one or two spark plugs which can be used with single or dual ignition battery or magneto.

(*Concluded on page* 284)



Exhaust side of Douglas Converted Ford engine.

How Air-speed Meters Work

by JOHN T. HAYWARD, Lieut. (J. G.)
U. S. NAVY

Air-speed meters are among the most important navigational instruments employed on an airplane, as they are functional as well as navigational. Here, the author explains their operative features in full detail, and in a simple manner.

THERE are two speeds of an airplane that concern the pilot, the air-speed and the ground-speed.

The air-speed is the speed of the plane with reference to the air. This is again divided into the indicated air-speed and the true air-speed, the latter being the indicated air-speed corrected for air density, temperature and instrument errors. The ground-speed of a plane is its speed relative to the ground which can be obtained from the air-speed by applying a correction for the wind velocity.

The air-speed concerns the pilot chiefly in getting the desired performance out of his plane and, of necessity *must* be used when flying by instrument. The ground-speed is essential for accurate aerial navigation and presents the most difficult problem.

Air-speed meters are in general composed of two distinct parts—an operating element which is exposed to the air flowing past the aircraft, and an indicating element mounted on the instrument panel. They may be classified according to the type of operating element as follows:

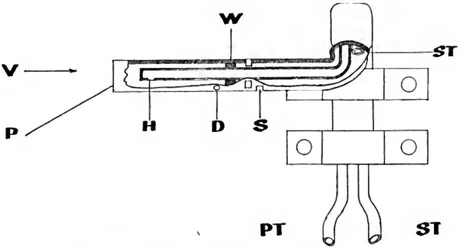
1. DIFFERENTIAL PRESSURE
   (a) Pitot Static
   (b) Venturi
   (c) Venturi Pitot
2. MECHANICAL
   (a) Rotating element
   (b) Deflecting element
3. THERMAL (hot wire)

The differential-pressure type is the type most generally used on aircraft today. Consequently, the mechanical and thermal types will only be discussed briefly.

The mechanical type of air-speed meter, with a rotating element, is the only type of instrument that is unaffected by changes of air density and then only when the element rotates with a negligible resisting torque. The true air-speed is readily obtained by correcting for fixed instrumental errors. These instruments, unaffected by air density, are especially valuable for flight test work, navigational use and on airships. Vane and cup anemometers with very little friction are examples of the above type.

A second type of mechanical air-speed meter is the pressure-plate type. It is made up of normal plate element which is deflected against a restraining spring by the direct impact of the moving air. This is the earliest form of aircraft speed instrument.

The chief advantage of the vane type air-speed meter is the measurement of air-speeds in the lower speed range (below 40 m.p.h.) where the differential pressure is so low that it is difficult to measure accurately with other types.



Schematic diagram of the air-speed pitot tube arrangement.

The only mechanical air-speed meter in use to any extent is the pressure plate type employed to a great extent on gliders. The disadvantages of this type far outweigh any advantages and it is little employed on power driven aircraft today.

The thermal air-speed indicator is essentially a laboratory instrument. Its present lack of ruggedness and other practical characteristics dismiss it from any consideration as a service instrument on an aircraft. The theory is based on the rate of cooling of a heated wire in an air-stream which depends, among other things, upon the relative speed of the air-stream and the wire. Therefore the heated wire may be used to measure this speed.

By far the most important type of present day air-speed meter is the differential-pressure type. The single venturi was the first of this series to be developed because it gave considerably higher differential-pressures than the pitot static and, consequently, a satisfactory indicator with a metal diaphragm was easily constructed.

The double venturi and the venturi-pitot were natural developments of the simple venturi. The advantages are no longer significant while the disadvantage of the sensitiveness of the venturi to small changes in dimensions necessitated careful manufacturing of each venturi, or individual calibration, so that the cost is too great to warrant continuing the type.

Now, by a process of elimination, we arrive at the Pitot-Static differential-pressure type of air-speed meter. This is the type employed practically by all planes in the United States. It will be discussed in full.

It consists of a pitot-static tube connected by two lines of tubing to a pressure gage which is calibrated in units of air-speeds. The pitot tube has an open end headed into the air-stream while the static tube has a closed end, similarly headed into the air-stream, and has a ring of small holes in the wall near the closed end. The air pressures within these tubes differ by an amount which depends both upon the velocity of the airplane through the air and the air density. The combination of these two tubes is known as the "pitot-static" tube.

At present there is no difficulty in securing reliable indicators which will operate on the differential pressures of a pitot-static tube over the usual range of speeds. The chief advantage of the pitot-static pressure head is that it can readily be duplicated so that individual calibrations are not required. It is thus suitable for a primary standard as well as a general service instrument.

This instrument is affected by air density and is of particular importance on an airplane. The differential pressure is proportional to the product of the air density and the square of the air-speed, at least within certain limits, and this is called the indicated air-speed. It also happens that the forces supporting the airplane in flight are also functions of the same quantities, hence the indicated speed is of unique value. The stalling-speed, for example, is always given by the same value of indicated air-speed regardless of the altitude of flight.

There are numerous types of pitot-static pressure heads in use on aircraft. The accompanying diagram shows one specified by the Bureau of Aeronautics and is of particular interest since it has been designed to withstand the severe service conditions encountered in Naval aviation.

The pitot tube opening is shown at (P) and at (PT), the line leading from the pitot tube to the indicator. The hole (H) in (PT) opens into the pitot tube. The small holes (D) permit water to drain from the pitot tube and do not change the pressure transmitted to the indicator. Static pressure is obtained within the portion of the tube with holes (S) in its walls opening into the air-stream. This pressure is transmitted to the indicator by the line (ST). The plug (W) separates the pitot tube from the static tube.

It is of concentric tube form with dimensions reduced to a minimum (consistent with other considerations) to cut down head resistance. The bend is to prevent passage of water. The horizontal offset permits mounting against the strut, thus placing the dynamic and static openings forward and to one side in a position of minimum interference. It is rugged and of a simple design with all precautions taken to reduce the chance of clogging the tubes with either rain or ice. Actual experience has proven the desirability of the above design.

The tubing in general use is copper, commonly three-sixteenths inch outside diameter. Brass fittings are employed. A drain is usually installed at the lowest point in the lines in the cockpit. Aluminum tubing is little used in the United States but finds considerable favor in England.

The indicator in general use is the metallic diaphragm type. Nickel silver and phosphor bronze have been found to be the most suitable material for diaphragms. The variable linear motion of this diaphragm is changed to the circular motion of the pointer. The diaphragm actuates a series of bell cranks and a cam surface on a sector which engages a pinion on the pointer shaft. This has also a restraining hair spring attached.

The results of an air-speed meter unit are dependent on correct maintenance. Leaks in the unit are the most frequent cause of failure to function correctly. They can be located readily by applying pressure to the pitot tube and observing the reading of the indicator. If the pointer remains steady there is no leak in the tube.

If it falls there is a leak present. The rate of fall is an indication whether it is a fast or a slow leak. The same procedure is done on the static tube with the exception suction instead of pressure is applied. The tubes should be kept clear of water and foreign bodies. When blowing lines out be sure that the indicator is disconnected or serious damage may be done to it. This applies whether the drains are opened or closed.

The errors of an air-speed meter unit are: (1) Installation error. (2) Instrumental error. The determination of the overall error is necessary to enable the pilot to compute his true ground speed. It is essential that he know his true air-speed to navigate accurately. The methods that have been used to determine the errors of an air speed meter unit are:

(1) Comparing the indicated air-speed with the speed of the airplane as determined by timing over a speed course.

(2) Comparing the indicated air-speed with that given by an instrument suspended from the airplane at a sufficient distance to make interference errors negligible.

(3)Flying in formation with an airplane whose speed factor has been previously determined.

(4) By comparison with an element mounted on a rod projecting far forward from the wing or strut.

The first method is generally employed because of its simplicity and the fact no extra equipment is required with the exception of a stopwatch. Accurate results can be obtained if a few simple precautions are followed strictly. The weather is usually the controlling factor as regards accuracy. The effect of a wind steady in direction as well as intensity, can readily be determined but such a wind is rare in nature.

Generally, it is necessary to wait for favorable conditions. If there is component of wind perpendicular to the speed course the plane should be flown so that its longitudinal axis is always parallel to the course. The crosswind will drift the plane off the course but correct results will be obtained if the time interval of the traverse is measured in the usual way.

The speed course should be long enough so that small errors in fixing the time of transit will be negligible in comparison with the total time of flight. For average use a length of two miles is satisfactory. The course should be level and chosen to have a direction such that the probability of crosswinds is a minimum.

In making a run, the course is flown in both directions and the time of each traverse measured by means of a stopwatch. The flight is made at as low an altitude as feasible so that the air density, determined by the air pressure and temperature, is practically that at the ground level. The ground speed of each traverse is obtained and then averaged to eliminate the effect of the wind provided the wind remains constant.

This average ground speed is the true air-speed for zero wind. The true indicated air speed is given by the following equation:

$$Vt = Vh\sqrt{\frac{Ps\ Th}{Ph\ Ts}}$$

Vt = True indicated air speed.
Vh = True air speed (average ground speed of runs)
Ps = Standard value of pressure.
Ts = Standard value of temperature.
Ph = Pressure at altitude of flight.
Th = Temperature at altitude of flight.

Air-speed meters are not usually calibrated for speeds near the stalling speeds of the plane on a speed course because of the attendant risk involved in flying at the required low altitude. Usually the second or third method is employed in calibrating for the above speeds.

Prior to taking the plane over the speed course, be certain that the installation is free from leaks and its lines clear of dirt and water. The obtaining of accuracy on the run is dependent to a great extent on the pilot's ability to fly at a constant indicated air-speed. Wait for favorable conditions before attempting calibration. If the calibration is free from errors, a smooth curve of average ground-speed plotted against engine-speed will be obtained. This calibration assumes major importance in aerial navigation requiring the accuracy demanded by Naval Aviation.

We now come to the problem of the determination of the ground-speed of the plane. From the standpoint of navigation, the subject of ground-speed is in a very unsatisfactory state. The methods in use are not only limited in application but are cumbersome and inaccurate. At present there is no self-contained ground-speed meter nor are there any promising ones in the experimental stage.

The obvious procedure, which is very useful on many occasions, is to measure the time of flight between two points on the ground whose distance can be scaled off the map, and hence derive the average ground-speed. It is necessary to pick a fairly long distance, in order to reduce errors in scaling from the map. The time is therefore considerable so that air-speed and wind-speed may vary during the run and considerable errors may result.

The best method for accurate results will be discussed. This is the method employed generally by the Pan American Lines and on all over-water flights though it is just as practical over land. It consists of a means of obtaining the drift of the airplane and a plotting board. The drift being obtained on two or more headings, three being generally used for accurate results.

These three drift sights are plotted and will intersect in a point or form a small triangle similar to the celestial navigation fix. The distance from the origin to the point of intersection or the center of the triangle is the force of the wind and its direction is from the origin toward the point.

A thorough knowledge of the velocity triangle must be had prior to the use of this method. Once the force and direction of the wind is obtained the ground speed is determined by applying a correction for this wind to the true air-speed of the airplane.

The accuracy of this method depends a great deal on the ability of the operator to get good drift sights also on the pilot who must maintain the plane on a constant course and speed while they are being taken. Smoke bombs are an aid to obtaining drift sights over water but they can be obtained without their use. There are numerous variations in the type of sights employed to obtain the above drift observations. The principle of the method is the same in every case.

The following procedure is given as a means of offsetting the disadvantage of having to turn away from the desired course. A drift is obtained on the original heading. The plane is then turned sixty

(*Concluded on page* 280)

Building the Mew Gull

by PAUL W. LINDBERG
Model Editor and Model Designer for
POPULAR AVIATION

Here is the completed model of the Mew Gull, typically English in its general design and appearance, it is a fine looking model and an excellent flyer.

THIS trim ship is of English design, and it is capable of very high speed plus exceptional maneuverbility. In our laboratory we enjoyed many interesting hours constructing the Mew Gull because of its simplicity and unusual clean lines. All controls are movable with aluminum hinges. False ribs can be cemented in the panels where necessary.

COLOR SCHEME

Entire model—white.

Details—red, silver and black; with exception of identification numbers which are turquoise blue.

Rudder—carries a red number 2.

CONSTRUCTION OF FUSELAGE

It is necessary to place a sheet of ordinary wax paper over the plan to prevent cement from sticking to it. In building the fuselage, construct one side at a time. The longerons, vertical and diagonal braces, etc., are held in place until securely cemented by inserting straight pins on either side of strips.

After the two fuselage sides are completed, they are pinned to top view of the plan in such a manner, that the top longerons face down and the sides are at right angles with the table. The cross-members are now cemented in place forming a rectangular fuselage.

Cut formers from 1/32-inch sheet balsa and cement in their respective positions as shown on plan. Select a soft piece of balsa for nose block which you carve and sand to shape. Stiff paper is needed for covering the fuselage around motor and top of fuselage to cockpit. The position of all stringers is clearly shown on formers.

CONSTRUCTION OF WING

Cut all ribs from 1/6-inch balsa. Pin center spar in position on plan. Cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape then cemented to the ribs. The wing panels carry movable ailerons, which are a great help in controlling the flights. Make wing tips from 1/16-inch balsa.

ELEVATOR AND RUDDER

These are built on the plan from 1/16-inch square and flat balsa. Their construction is very simple, therefore, no difficulty should result here.

FILLETS

The wing fillets are made from stiff paper and cemented into position on each side of fuselage. Angle is not required.

LANDING GEAR

To assure best results, may we suggest that you select a strong grade of balsa for the struts. These are fitted to the streamline wheel coverings and reinforced with short lengths of wire. Refer to plan. The wing panel is reinforced at rib H to receive upper part of landing gear strut. SEE PLAN.

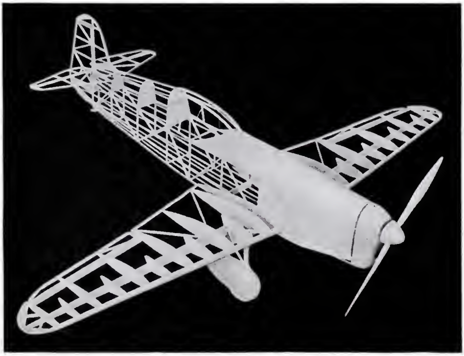
COVERING THE MODEL

Apply tissue to the various framework members. Use a light grade of model-airplane dope for sticking the tissue to the outer edges. To remove all wrinkles, stretch tissue tightly as possible. When edges have dried, apply coat of water to tissue. After water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such to a flat surface to keep from warping. Now apply a coat of clear dope to all surfaces. Colored dopes should be applied next. Do not assemble model before covering with tissue. Wings, elevator, etc., are cemented to fuselage after they have been completely covered with tissue.

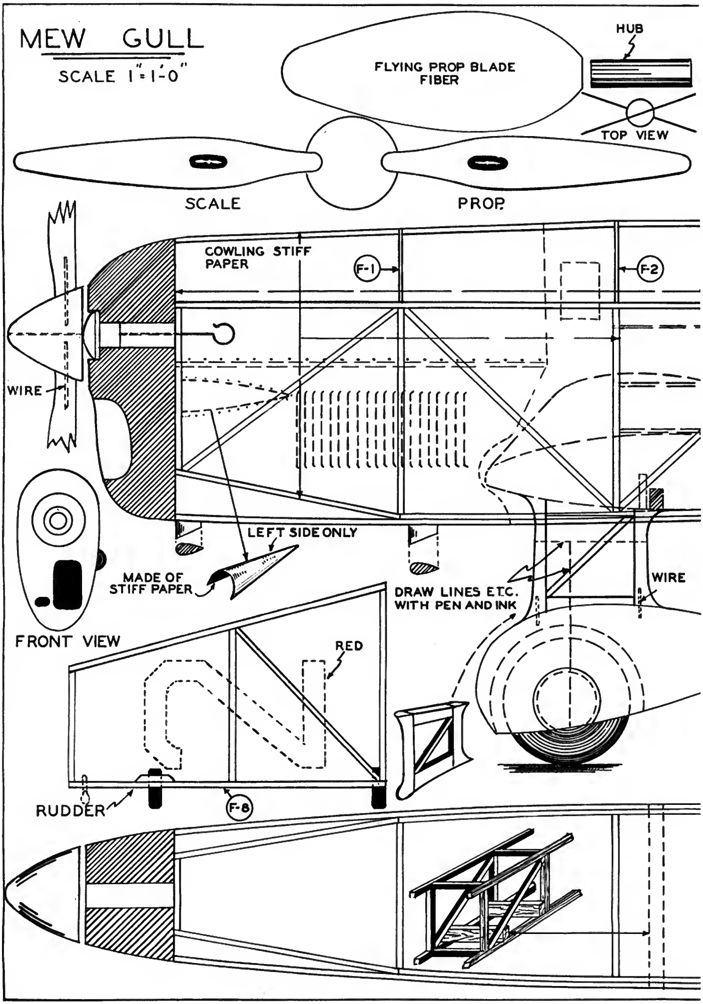
ASSEMBLY

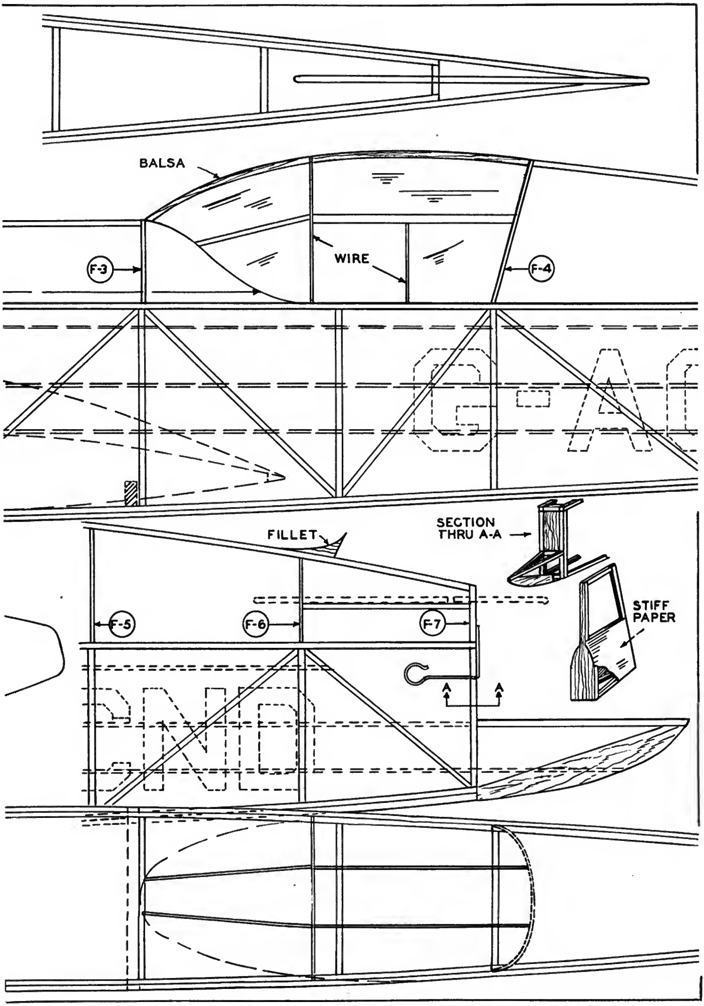
The wings, elevator, rudder and landing gear, etc., can be cemented in their

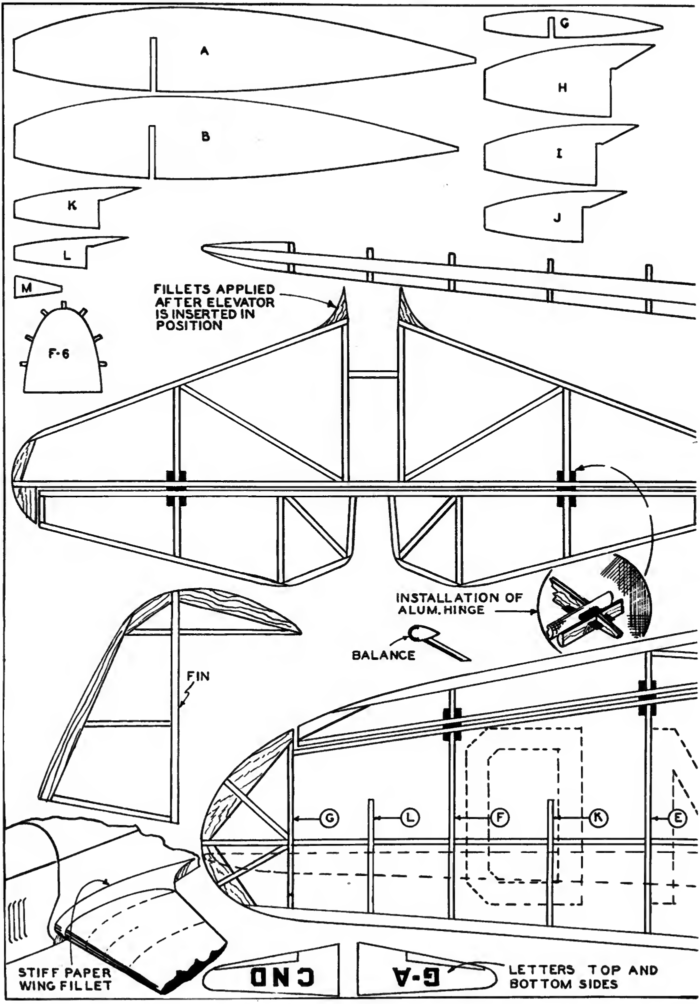
(Concluded on page 284)

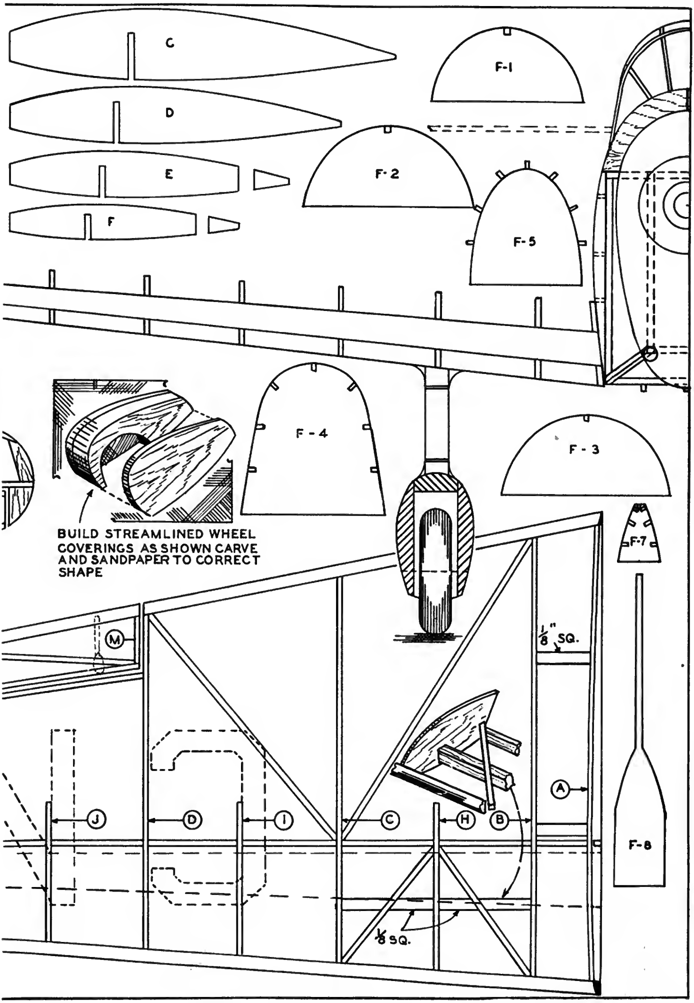


The framework of the uncovered Mew Gull is a fine example of airplane model construction.


MEW GULL
SCALE 1"=1'-0"
FLYING PROP BLADE FIBER
HUB
TOP VIEW
SCALE
PROP
COWLING STIFF PAPER
F-1
F-2
WIRE
LEFT SIDE ONLY
MADE OF STIFF PAPER
DRAW LINES ETC. WITH PEN AND INK
WIRE
FRONT VIEW
RED
RUDDER
F-8


BALSA
WIRE
F-3
F-4
G-A
FILLET
SECTION THRU A-A
STIFF PAPER
F-5
F-6
F-7
A
A
PND


A
B
G
H
I
J
K
L
M
F-6
FILLETS APPLIED AFTER ELEVATOR IS INSERTED IN POSITION
INSTALLATION OF ALUM. HINGE
BALANCE
FIN
G
L
F
K
E
STIFF PAPER WING FILLET
CND
G-A
LETTERS TOP AND BOTTOM SIDES



BUILD STREAMLINED WHEEL COVERINGS AS SHOWN CARVE AND SANDPAPER TO CORRECT SHAPE

Jokes

(Continued from page 268)

afterwards the owner was able to brag about the time when his plane smashed up and didn't hurt him at all.

And now I'm going to tell about the oddest case I ever knew. It seems there were two young men named John and Jim, who were twins. They looked alike, dressed alike, spoke alike. They were both in the same business, and people were constantly having difficulty in telling them apart.

But there was one difference. John could run an airplane and Jim could not. Therefore, if you wanted to know which was which, all you had to do was to go up in an airplane with one of the twins. If you landed safely, it was John. If you didn't, it was Jim.

And then there is the story about the newspaper man who arrived at the scene of an airplane crash. Rushing up to the first person he saw, he said,

"I'm a newspaperman. I've come to cover the wreck."

"That all right by me," said the man, looking at the pile of junk that had been a plane, "but you'll have to provide your own shovel."

And so it goes. We all know of the ups and downs in aviation—mostly downs—but it's a great old game after all's said and done.

END.

Gilmore

(Continued from page 248)

Mining associates were helping Gilmore with his inventions, but they were beginning to become disgusted and were threatening to withdraw their financial support. They finally told him they were through, but he asked for one more day. But this second day brought no success for he still did not have a plane which he could keep balanced.

Late that afternoon, Gilmore went to the hill tops to study the flight of the birds again as he had often done before. It was during his hours of study that evening that he had a vision of an airplane with the motor in front of the cabin.

The next morning he and his workers moved the engine ahead of the plane seat. Just before he took off, his partners loaded a sandbag on the tail. They were certain it would nose dive with the weight of the engine in front. Awkwardly the glider took off, staggered and settled to the ground.

Disgustedly they all left the ship but Gilmore. He stayed, cutting the sandbag loose. He started the motor and without faltering, the little plane sailed across the small valley and made a perfect landing.

When Gilmore discovered this secret of balance, he solved the center of pressure movement. It was in April, 1896, when Gilmore made this flight. From then on, he built and improved his gliders and flew one after another as he concentrated on making each one better than the previous one.

This same year Dr. Samuel Pierpont Langley, astronomer, engineer, and scientist, unsuccessfully launched his planes from catapults.

In 1903, the Wright brothers became famous by their flight in a pusher type plane at Kitty Hawk. A year before that, in 1902, Gilmore flew a glider type plane powered by a steam engine which he had invented. The steam, he believed, was too dangerous so he discarded it, later substituting a gasoline engine.

Soon after powering his glider with the steam engine, he started planning the eight-passenger cabin monoplane with its present day qualifications. It had a wing span of 65 feet and a length of 35 feet.

He claims that center of gravity and air pressure on his ship was scaled so accurately on the drawing that when the ship was completed the center of gravity was not more than one-half inch off the center of air pressure.

He tried to buy a motor large enough to turn the big propeller but could not. He bought what he thinks was the first Darracque motor imported to the United States for balloons. But, alas, this motor was not big enough. It would not turn the giant propeller fast enough.

This was a blow to his plans, but still undaunted, he built a smaller ship that would fit the motor. This airplane was almost identical to the design of the Curtiss Robin, a cabin plane with dihedral and low center of gravity.

Gilmore was 24 years old in 1898, and in that year he designed a cabin all-steel body plane. He thoroughly believed in it. So much so, that he wrote the United States War department, suggesting that the United States lay the foundation for an air fleet. Of course he was laughed at and ridiculed, every one thinking he was a little queer on the subject. But considering aviation as it is to-day, Gilmore knew what he was doing, even if others did not agree with him.

END.

GAS MOTOR DRIVEN SCALE MODELS
NEW LOCKHEED ARMY SPEED VEGA
NEW NEW

82" Span. Length 54½". 2" Scale. Weight 5½ lbs. with motor

This is an exact scale model of the latest Army Vega, beautifully streamlined. A speciel de luxe flying gas model with all formers, wing ribs, lips, wheel pants, already cut out and notched. Turned balsa motor front, 4½" pneumatic air wheels, silk covering, army blue and yellow dope, glue, etc. Model has removable wing, and is specially designed for gas motor. It is very strong, practically crashproof—there being no exterior parts or struts to break. Takes off in 30 foot run, flies over 1 mile on ¼ oz. of gasoline. Const. set, complete without motor, postpaid $25.00

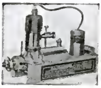
5½ Foot BOEING F4B4
1/5 H.P. GAS MOTOR DRIVEN MODEL

Span 66". Length 45". Scale 2¼".

Specially built model with all parts ready cut out such as formers, wing, ribs, etc., silk covering, 6" wheels, special 10" turned balsa cowl and motor unit, silver dope, glue, etc., 2 full size scale drawings. Const. set without motor, postpaid $25.00

1/5 H. P. GAS MOTOR
Weight as shown, 12 oz.

Long life motor has steel cylinder and piston, ⅞" bore x 1" stroke. Comes complete with gas tank, coil, condenser batteries. Price ready to run, complete, postpaid. Only $22.50



Motor comes mounted as shown. 15" or 19" laminated prop. for motor.................$2.75

THIS MOTOR IS USED ON MODELS SHOWN

Send 3c Stamp for Catalog

MINIATURE AIRCRAFT CORP., 83 LOW TERRACE NEW BRIGHTON, N. Y.

Air-Speed

(Continued from page 274)

degrees to the right and another drift obtained. A turn of 120 degrees to the left is then made and another sight taken. When back at the point of the original course the distance made good on the original course will be one-half the distance that would have been made good if the plane had not deviated from the original. Flight is then resumed on the original course. The above is apparent when plotted as an equilateral triangle. This is approximate but close enough.

As is readily seen the measurement of ground speed is far from being accurate at the best. When one realizes the importance of this quantity in aerial navigation it is readily seen what a tremendous step forward a self-contained accurate ground speed meter would be.

END.

ATTENTION unsuccessful MODEL BUILDERS!

To everyone who ever FAILED to build an All-Balsa-Stick Kit

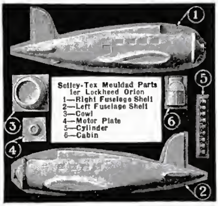
SELLEY OFFERS this FULL-MONEY-BACK-GUARANTEE

Knowing the many advantages SELLLEY-TEX has over All-Balsa-Stick Kits, we make this offer confident that you'll find SELLEY-TEX "moulded" construction the type of kit you have always longed for but could never get. This revolutionary, simplified method is giving more "building" pleasure and more "satisfying" results to novices as well as experts, than any All-Balsa-Stick Kit on the market possibly could. For IF YOU CAN'T BUILD A MODEL PLANE THIS NEW EASY WAY, YOU CAN'T EVEN BEGIN TO CONSTRUCT THE OLD-FASHIONED ALL-BALSA WOOD KIT! And we issue this Full-Money-Back Offer in order that YOU can find out for yourself the difference SELLEY-TEX "moulded" construction makes in the successful building of true-to-scale, fast flying miniature planes.

We know model builders like SELLEY-TEX, once they try this Modern Method of Model Building. Since the introduction of these LOWER PRICE "star" SELLEY-TEX Construction Sets, thousands of these kits have been sold. WE HAVE NOT HAD A SINGLE KIT RETURNED OR RECEIVED ONE LETTER OF COMPLAINT. No greater tribute to the SUPERIORITY and VALUE of SELLEY-TEX is possible! We are constantly getting testimonial letters and repeat orders from those who have changed to SELLEY-TEX and found new enjoyment, new benefits. We want you to share their enthusiasm. TRY SELLEY-TEX! Read the coupon below and ACT NOW!

IF YOU DO NOT JUDGE THE SELLEY-TEX CONSTRUCTION SET YOU BUY TO BE THE EASIEST, SIMPLEST AND MOST PRACTICAL WAY TO BUILD A FLYING MODEL PLANE YOU EVER TRIED, JUST RETURN IT TO US AS RECEIVED AND WE WILL GLADLY REFUND THE FULL PURCHASE PRICE IMMEDIATELY AND WITHOUT QUESTION.

(Signed)
SELLEY MANUFACTURING COMPANY, INC.
BROOKLYN, NEW YORK, N. Y.



Selley-Tex Mouldad Parts for Lockheed Orion
1—Right Fuselage Shell
2—Left Fuselage Shell
3—Cowl
4—Motor Plate
5—Cylinder
6—Cabin

Each of the SELLEY-TEX Construction Sets contain the necessary individually designed moulded scale parts similar to those shown above.

*"I just finished building your Monocoupe and want to say it has exceeded my greatest expectations. I'll never go back to the all wooden kits again."

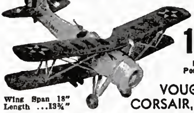
1.25
15c Postage

Wing Span, 20"
Length ....12½"

MONOCOUPE

A beautiful miniature of the popular original and what a flyer!

* "I had a lot of fun building the Vought Corsair, Jr. model and made a profit, too. I sold the finished job to a friend for $3.75. SELLEY-TEX kits for me from now on!"



1.25
15c Postage

Wing Span 18"
Length ...13¾"

VOUGHT CORSAIR, JR.

This latest formidable looking military plane complete with guns, bombs, etc., is built for stamina and designed for speed.

PARTS AND ACCESSORIES

Every model is packed in a beautiful, sturdy box with semi-finished flying or scale propeller, formed wire hooks, scaled wheels, with brass bushings, ribs printed out accurately on white sheet balsa, many special turned wood parts, finest grade of balsa wood sticks, tail wheel and fork fittings, and wire, pure para rubber, colored paper, authentic markings, colored insignia, best quality cement, colored dopes, full-size easy-to-understand plan.

Space does not permit illustrating any of the six models which Comprise the DE LUXE line of SELLEY-TEX Flying Scale Model Construction Sets. All 24 inch wing span. Complete with all tools necessary to build model. For full listing, order from coupon or see FREE offer below!

FREE! Just off the press! Write for our new beautiful, two-colored broadside illustrating in detail the new line of incomparable lower price SELLEY-TEX Construction Sets. Send 3c stamp for postage.

A brand new supply catalogue picturing and listing the most popular plane accessories is yours for the asking. Send 3c for postage.

*"After my friends showed me the easy SELLEY-TEX method of building the difficult parts of a model, I decided to discard the old way and have built your Lockheed Orion for our annual Hobby Show."

Wing Span...20"
Length ....12¾"

1.25
15c Postage

LOCKHEED ORION

An amazing realistic replica of this famous transport

READ CAREFULLY these 10 ADVANTAGES SELLEY-TEX offers over All-Balsa-Stick Kits!

★ **MOULDED CONSTRUCTION.** First real advancement in practical model airplane building. The production investment exceeds the costs of most of the All-Balsa-Stick Kit manufacturers combined!

★ **EXCLUSIVE FABRIC.** Specially close woven and processed by secret formula. The smooth moulded surface can be beautifully finished in any color combinations with dope or lacquer.

★ **EASIER-TO-BUILD.** The moulded parts make it simple as A B C. Novices as well as experts easily and successfully build and fly planes this new simple way.

★ **MORE PRACTICAL.** Selley is discontinuing All-Balsa-Stick type of kit entirely. An analysis showed that less than 2% of those who try, can actually complete an All-Balsa-Stick Kit!

★ **MORE AUTHENTICALLY DESIGNED.** Minute details are moulded into model. Each is an exact, true-to-scale miniature of the original plane perfect in every detail.

★ **MORE DURABLE.** The moulded fabric shells are stronger though lighter. They will not warp, tear or puncture and are practically crash-proof and unbreakable.

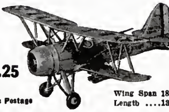
★ **BETTER FLYERS.** The moulded fuselage eliminates weight behind center of gravity which is approximately 95% perfect in all models assuring better flying performance.

★ **POSITIVE MEANS OF BALANCING.** Simple ring device correctly balances plane. A new clever feature found only in these moulded models.

★ **PATENT APPLIED FOR.** The moulded process is an original creation owned exclusively by Selley.

★ **MONEY BACK GUARANTEE.** A full protection money back guarantee certificate is included in every kit!

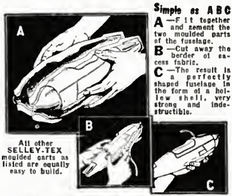
CURTISS OSPREY



1.25
15c Postage

Wing Span 18¼"
Length ....13½"

Exceptional flight performance, authentic beyond belief. Full military equipment, guns, bombs, etc., for realism.



Simple as A B C

A—Fit together and cement the two moulded parts of the fuselage.

B—Cut away the border of excess fabric.

C—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible.

All other SELLEY-TEX moulded parts as listed are equally easy to build.

* Letters on file in our office.

* "The Rearwin Sport kit I constructed looks like a prize contest winner to me. I think SELLEY-TEX is the greatest bargain ever offered on the market."

75c
15c Postage

REARWIN SPORT

Wing Span.16"
Length ....10"

Simple to build and realistic in all details! A great flyer too! Wonderful Value!

* "If the Bellanca Swoop kit is one-third as excellent as your $3.00 Ryan Sport I built, I am truly getting full value for my money. Lots of luck to SELLEY-TEX!"

1.00
15c Postage

Wing Span, 20"
Length ....11½"

BELLANCA SWOOP

A perfect authentic reproduction of this famous London to Melbourne racer.

Dealers! Jobbers! Sales Representatives!

Wide awake merchants will appreciate the tremendous sales appeal of these new competitively lower priced SELLEY-TEX kits. CASH IN on these exclusive sell-on-sight sensations. Write today for complete information, discounts, etc.

Try your leading Dept. store or local dealer first. Use coupon if you can't get SELLEY-TEX. Please mention your dealer's name and address.

Please send me the SELLEY-TEX model kits I have checked. I am enclosing $......., (check or money order). (Each plane 15c postage. West of Denver 25c postage.)

MONOCOUPE	$1.25 ☐	REARWIN	$ .75 ☐
VOUGHT CORSAIR	1.25 ☐	BALLANCA SWOOP	1.00 ☐
LOCKHEED ORION	1.25 ☐	CURTISS OSPREY	1.25 ☐
†NEW RYAN SPORT	3.00 ☐	†FAIRCHILD	3.00 ☐
†WACO C CABIN	3.50 ☐	†BOEING F4B4	3.50 ☐
†WACO O MILITARY	4.00 ☐	†GOSHAWK	4.00 ☐

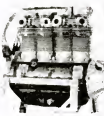
†These models 25c postage, west of Denver 40c.

PRINT NAME ....
ADDRESS ....
CITY AND STATE..
DEALER'S NAME ....

SELLEY MFG CO. INC., DEPT 404 B 1373 GATES AVENUE, BROOKLYN, N. Y.

MODEL THOMPSON SUB MACHINE GUN $3.00
Actual size construction kit, machined barrel, magazine, necessary hardware and working plans........$3.00
Colt calibre .45 automatic pistol.......................... 1.00
Colt calibre .25 automatic pistol.......................... .50
Savage calibre .32 auto. pistol with mach. barrel.... .75
Luger auto. pistol cal. 9M/M w/4" mach. barrel.... 1.75
Colt single action Frontier revolver with machined cylinder, rod ejector and 4¾" barrel.............. 1.45
Half size THOMPSON SUB MACHINE GUN kit... 1.50
These handsome kits are semi-finished, cut to outline and do not require the use of any special tools. Postpaid in U. S. A. No stamps, please. Checks 15c extra.

GUN MODEL CO., Dept. K.
2908 N. Nordica Ave., Chicago, Ill.



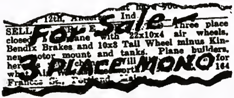
DOUGLAS
70-Horsepower
AIR-COOLED ENGINE
MODEL "A" CONVERSION

What every lightplane builder has been waiting for. The new Air-cooled Model "A" conversion—70 H. P. Easy to build with DOUGLAS conversion parts. Can be used on Iceboats, Snowsleds, etc. Send 25 cents for information, photo and price list.

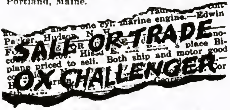
DETAILED BLUE PRINTS $3.75

H. Douglas, 936 Madison St., Oak Park, Ill.

The Quickest Way To
SELL YOUR PLANE


For Sale
3 PLACE MONO

—"34 answers were received to the above ad. I disposed of the whole outfit."—E. P. Cate, Portland, Maine.


SALE OR TRADE
OX CHALLENGER

—"the above ad drew many replies and I sold the plane within a short time at a good price."
Ira J. Sellers, Clarksville, Tenn.

The above two cases are representative of many we receive testifying that POPULAR AVIATION blankets the market for airplane sales. If you have an airplane glider, equipment or supplies to SELL QUICKLY, let POPULAR AVIATION do the job for you. For advertising rates, address Advertising Manager, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

Rickenbacker

(Continued from page 258)

back and was knocked out of the war. He was the outfit's first casualty—fortunately not a fatal one—and the boys began to see that chasing Germans was not all beer and skittles.

Even as they were still depressed over the plight of the genial Iowan, news came in July that Winslow had knocked off his second victory—a Fokker—but in so doing, had been dangerously wounded and had fallen behind the German lines and been made a prisoner. Winslow lost an arm after ghastly suffering in a German hospital-prison and remained interned for the duration of the war. He survived, however, only to succumb 12 years later to injuries incurred when he accidentally fell from a hotel window in Canada.

But it was not enemy guns that removed the wily Rickenbacker. In Paris he was stricken with fever and was powerless to get back to the front until July. When he did show up, he found that the First Pursuit Group now contained the 27th and 147th Aero Squadrons. The former was commanded by Maj. Harold E. Hartney, of New York, who numbered in his command Frank Luke, of Phoenix, Ariz., who was to "bust" 13 balloons and 8 planes, and Joe Wehner. Joe was Luke's close friend. He was killed after his eighth victory and his flaming death is said to have made a homicidal maniac out of Luke.

In the 147th, commanded by Maj. Geoffrey Bonnell, was Wilbert White, of New York, who rammed a Fokker—his eighth—to save a comrade, and hurtled to his death.

More remarkable is the Rickenbacker record when you understand that malignant fever kept him out of the fighting for five entire months! Meanwhile his comrades were daily patrolling the lines and getting plenty of practice for the dark days of autumn, 1918, just 16 years ago.

Eddie forced himself to return to the front despite his illness. But it was no go. He returned to the pill rollers and those gentlemen didn't let him loose until September. But when he did come back, he lost no time swinging into action.

On Sept. 14 he had his sixth tally and by Sept. 24 so great was his energy and so marked his leadership—he was made commanding officer of the 94th. He went out next day and got his seventh and eighth as an example to his men!

Rick was a great believer in esprit de corps and discipline. Had he not been the commander of a squadron of army planes, he would have made a great football coach. His tactics in getting results from his men bordered on the genius of an Alonzo Stagg or a Walter Camp. He called them together, talked over problems, gave pep talks. And his generalship worked. The 94th wound up its share in the war with a count of 69 officially accredited victories—and the heavens only know how many more.

I have purposely avoided detailed description of Rick's victories. They did not savor of Guynemer whose exploits had a rapier-like finesse; they did not resemble the recklessness of Nungesser; nor were they like unto the ferocity of Lufbery. In short, they were not showy affairs. They were full of drama, for Rick was a good stage manager. But witness:—

On Sept. 25, just after victorious St. Mihiel, Eddie met a patrol of five Fokkers convoying 2 LVG photographics. This was near Etain, east of Verdun. The escort was hovering high above the LVGs, hungry as wolves for a snap at anyone so audacious as to attack their charges.

But Eddie had the sun back of him. Roaring down on their unsuspecting tails, he had a Fokker before the latter knew what hit him. Instead of retreating, the intrepid ex-racing driver made a quick climb and swooped again. The Fokkers made way with themselves and the LVGs parted company. One kept up a steady stream of bullets aimed at Eddie—all going wild—so the Ace cannily took after the other. And sent him down in flames.

Two in one day! What an example for the 94th. Who can doubt it had its effect! Not every squadron boasts a commander who goes out the first day of his regime and comes back with two victories in a singlehanded encounter with Fritz!

END.

You learn more here because there's more here about which to learn

★ School is owned and operated by Roosevelt Field, Inc., (paid in capital over $5,000,000), also operators of famous Roosevelt Field—America's Largest and Busiest Civil Airport.

Over 50 buildings, housing some 200 airplanes and 50 operators engaged in various aeronautical pursuits, and some 500 acres of developed flying area comprise this vast airport and provide facilities and an atmosphere not found in any other school.

School established eight years with proven record of over 35,000 safe instructional flying hours and hundreds of successful flying and mechanic graduates.

Separate training field for flight students. Surrounding territory safe and ideal for flying and flight instruction.

Finest practical mechanical training given on live engines and licensed airplanes in government approved repair depot No. 181 of the school.

Location of Eastern Regional Office of Bureau of Air Commerce in school hangar brings wealth of interesting airplanes of all types and famous aviation personalities to school field.

INVESTIGATE BEFORE YOU INVEST

AVIATION TRAINING

Roosevelt Aviation School is the only Government Approved Transport and Mechanics School in the East

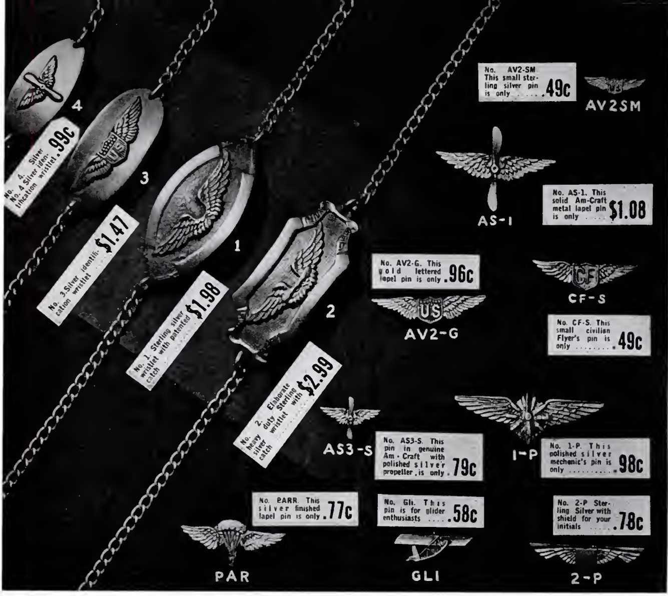
Here you can qualify for any flying license from Amateur or Private Pilot for Sport flying to Limited Commercial or Transport Pilot for professional flying—or for the Airplane and Engine mechanics licenses as issued by the U. S. Bureau of Air Commerce.

This highest federal rating, the years of experience, the ideal training location on famous Roosevelt Field, the expert staff of rated instructors and the unsurpassed, modern training equipment of this internationally recognized institution of aeronautical instruction assures you of the most complete and practical training in the course of your choice at no extra cost than for ordinary instruction. Only thorough training is effective and productive—get it at Roosevelt. ***For information write or phone (Garden City 8000) or visit the School. Ask for free booklet (PA). Kindly state age and course.***

TRAIN AT A SCHOOL THAT IS IN THE BUSINESS IT TEACHES

ROOSEVELT AVIATION SCHOOL

ROOSEVELT FIELD MINEOLA, N. Y.



No. 4. Silver No. 4 Silver identification wristlet .99c

No. 3. Silver identification wristlet $1.47

No. 1. Sterling silver wristlet with patented catch $1.98

No. 2. Elaborate heavy duty Sterling silver wristlet with catch $2.99

No. AV2-SM. This small sterling silver pin is only .... .49c

No. AS-1. This solid Am-Craft metal lapel pin is only $1.08

No. AV2-G. This gold lettered lapel pin is only .96c

No. CF-S. This small civilian Flyer's pin is only .... .49c

No. AS3-S. This pin in genuine Am-Craft with polished silver propeller, is only .79c

No. 1-P. This polished silver mechanic's pin is only .... .98c

No. PARR. This silver finished lapel pin is only .77c

No. Gli. This pin is for glider enthusiasts .... .58c

No. 2-P Sterling Silver with shield for your initials ..... .78c

RINGS

RING A is Solid Sterling Silver Price $1.9

RING B is slightly smaller and plainer. Also Sterling Silver $1.9

RING C is attractive and petite sterling silver design for ladies $1.9

RING D is Solid Silver with engraved black onyx setting. Price $6.4

Give ring size—wrap string around finger, cut to size and send.

A PAGE OF FAMOUS KARL ORT VALUES

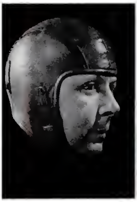
Shatterproof Goggles

"Resistals." Widely used by commercial pilots. Extra large, flat, shatterproof lenses. Large, comfortable soft rubber mask excludes all wind. They will not fog. Regular price $4.50. Now postpaid **$2.99**

Real black leather, gold propeller and wing on front. 32 pages $3\frac{1}{2}$"x6". Approved by Dept. of Commerce. Postpaid, only 75c.

SNUGFIT GOGGLES

Wide vision, perfect ventilation, sturdy construction, interchangeable lenses. Have soft, form-fitting sponge rubber cushions with patented air fin to prevent leaks around nose and cheeks. Wide elastic band. Nickel-plated frame. Postpaid **$2.78**



WINTER HELMETS

rmy-type. Real imported ape leather, chocolate rown. Give hat size. Inlined. Postpaid.. **$1.98**
ame, with chamois lining nd powder-puff ear pads. 'ostaid............... **$2.98**

SILK MUFFLER

Real parachute white silk muffler. ½ yard wide, 1½ yards long with the parachute and plane designs as shown. Swell looking. Postpaid..... **$1.59**

FLYING SUIT

This Summer Flying Suit is of the finest quality White Sanforized (Pre-shrunk) herringbone, zipper equipped. Sizes 36 to 48 only......... **$2.98**

SUMMER HELMET

Here's a real buy. Matter-of-fact my present low-price is below the present day manufacturing costs. This Summer Helmet is ideal for a drafty cabin in winter or open cockpit in summer. Soft silky white Gabardine, real leather chin straps, goggle strap with snaps. Sewn with silk thread. Give hat size. Postpaid **57c**

MY GUARANTEE If within 3 days after you receive your order, you tell me you are not satisfied with the goods I send you—I'll return your money immediately. No argument—no questions asked. I can operate on this broad, wide-open policy because I KNOW what sensational values I offer and I want to keep you as a satisfied customer. Send right now for my new Bargain Catalog. Compare the prices listed with those you'd have to pay for the same equipment anywhere else than at Karl Ort's.

I can save you as much as 30-50%

Send for Ort's Bargain Book Toda

MY Bargain Book will save you as much as 50% on airplane parts, equipment and clothing. And it's all absolutely new—not used equipment or "seconds". Practically all of these supplies carry the manufacturer's name right on them. I can assure you of such unbelievable savings simply because I bought a lot of accessories, equipment and supplies many months ago when prices were right down to rock bottom and I bought immense quantities, so I got a "break" on price. There are thousands of these items listed in this well-illustrated catalog.

I'll mail you one of my Bargain Books if you'll send me one thin dime to cover postage and handling. And I'll return your dime with your first order—large or small. Fair enough, isn't it? I guarantee that this amazing catalog of price-slashed equipment will mean money in your pocket on any article you buy.

FREE!

With YOUR FIRST ORDER

KARL ORT, 675 West Poplar Street, York, Penna.
O. K. Ort:—

☐ Send me your new catalog right away. Here's your thin dime. (Canad 20c.) I sure want it back when I send you my first order.

☐ Send me the items I have checked or ringed in the above ad. I enclos check or money order. You pay the postage. Also send Bargain Boo FREE.

Name ....

Address ....

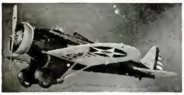
City.................................... State.....................

Only Good Kits make Good Models!

Wise model builders never waste time and money trying to make good models with incomplete, poorly assembled Kits. That is one reason why they prefer IDEAL "Super Detail" Kits. They build beautiful, guaranteed Flying Models in exact scale, with cockpit operated controls. Pick your next job from the Kits below and you, too, will be glad you did!

SuperDetail

100% Scale Models



BOEING P-26-A Wingspan 21¼ in.
Length 19 in., Weight 2½ oz., Scale ¾ in.; beautifully colored olive drab and yellow. Complete Kit **$1.75**

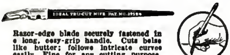
RYAN ST—Wingspan 22½ in., Length 16½ in. Weight 2½ oz., Scale ¾ in.; with duel control system operated in either cockpit; adjustable wing flaps; and plans for making an engine with 4 cylinders, carburetor, spark plugs, etc. Complete Kit $1.50

CURTISS GOSHAWK—Wingspan 23⅝", Length 16¾". Weight 3⅜ oz., Scale ¾". Complete Kit $2.00

STINSON RELIANT—Wingspan 32 5/16", Length 21¼", Weight 3½ oz., Scale ¾". Complete Kit $2.50

MARTIN BOMBER—Wingspan 35", Length 22½", Weight 4⅝ oz., Scale exact. Complete Kit....$3.50

Try this New IDEAL Tru-Cut Nife


IDEAL TRU-CUT NIFE PAT. NO. 39594

Razor-edge blade securely fastened in a long, easy-grip handle. Cuts balsa like butter; follows intricate curves easily. Fine for any cutting purpose. Get one!
Postpaid for 15c each; extra blades, 3 for 10c.

IDEAL'S NEW SENSATION Mickey Mouse Flying Airplane

(Not a Construction Kit)

Flies 100 to 300 Feet. A tough, durable, feather-light finished airplane that is ready to fly when you get it. 16½" wingspan, 12" length, 1 3/16 oz. weight. Beautifully colored red, black and yellow. Get one! You'll say it's the trickiest plane you ever saw! Price postpaid **75c**

DeLuxe Model; extra wing and two rubber motors. Postpaid $1.00

Illustrated Catalog — Bulletins

Beautifully Illustrated Bulletins of Model Ships and Airplanes, with Lists of Boat and Airplane Parts, Supplies and Materials—all for only 5c.

Pacific Coast Branch:
Model Boat & Aircraft Co.,
1356 5th Ave., San Diego, Calif.

IDEAL AEROPLANE & SUPPLY CO., INC.
22-26 W. 19th St., New York City.

Please send the items I have checked. I am enclosing $.................. (West of Denver 25c extra. All planes postpaid.) Canadian Prices 40% higher to cover duty.

Boeing P-26A ☐ $1.75 Stinson Reliant Airliner ☐ $2.50
Martin Bomber ☐ $3.50 Curtiss Goshawk ☐ $2.00
Ryan S T ☐ $1.50 Mickey Mouse Airplane ☐ 75c ☐ $1.00
Tru-Cut Nife ☐ 15c Catalogue Bulletin ☐ 5c

Please print name..................................
Address ....
City .... State...........

Model Department

(Continued from page 275)

correct positions. The cockpit covering is made from wire and celluloid. Shape wire to correct form and cover carefully with celluloid. All other details and markings can be drawn with pen and ink.

TESTING AND FLYING

Two types of propellers are used on this model. One, which has a wide blade, is made of fiber. This type of blade causes the motor to turn at less r.p.m and greater flights result. By twisting the blades, the pitch can easily be adjusted. The balsa scale propeller is used for exhibition purposes only. Six strands of 1/8-inch flat rubber are sufficient to fly the model.

With the rubber motor and flying propeller in place, gently launch your model over tall grass. By this method, you can see if your model is properly balanced. If model glides a short distance, and nose rises abruptly, it will be necessary to add weight to bottom of nose block. If model dives, add weight to tail.

After the model is balanced to glide on an even angle, you are ready to test your model under power. In making test flight, the principal thing to avoid is damage to your model. Gliding and flying it over tall weeds is the safest, because the weeds or tall grass break the fall gently in case that the model should stall or dive.

A few trial flights will acquaint you with the ship, and all other adjustments can be made through the adjustable control surfaces.

END.

BIG MONEY Building New Portable SPORTSMAN'S BOAT
For FISHING·CAMPING HUNTING·SAILING

MEAD Sportsman's KI-YAK is the most *sensational* boat development in years. Exclusive *new* structural features set a new standard for lightness, strength, durability, beauty and ease of *home-assembly*. Easily ***PORTABLE.*** Low introductory prices! Special "*Pay As You Build*" Plan.

Opens new world of sport in sailing, paddling, camping, fishing, auto touring! $6 Paddle now GIVEN with your Cut-to-Fit Kit or Factory-Built KI-YAK—*if you hurry*. *Rush* 10c for Catalog today!

and PAY AS YOU BUILD!

MEAD GLIDERS 15 South Market Dept. E-4 CHICAGO

Miss Cheung

(Continued from page 249)

"There is so much chance here," she said, thinking perhaps a little wistfully of the girls in Canton who have to stay on the ground and watch their brothers fly.

Chinese residents of Los Angeles are enthusiastic supporters of Miss Cheung. She has taken not only the members of her own family for flights, but scores of other Chinese, young and old. Many of them say they would rather fly with her than with anyone else.

Aviation unexpectedly brought Miss Cheung a new activity—public speaking. She is much in demand as a speaker before clubs, although she learned her English only after she came to Los Angeles eight years ago. She speaks now with entire fluency and only a bit of accent. And that reminds her of a story of her school days in Canton.

"We had an hour every day when we were supposed to speak English, if we wanted anything," she said.

"The teacher used to say: 'Girls, what's the matter with you—there must be something you want to say and it isn't natural for a roomful of girls to be so quiet.'

"But there we would sit, never opening our mouths, until the hour was over, and then we made up for lost time—in Chinese."

So, if Katherine Cheung's piano is silent now, she is listening to another kind of music made by roaring motors and whirling propellers, and she's making up for lost time—in the air.

END.

Model "A"

(Continued from page 272)

By eliminating water tanks, radiator, pipes, hose connections, etc., the weight has been reduced to 225 pounds ready to fly, which will substantially increase the pay-load above that of the water-cooled job.

Using standard 3⅞ bore by 4¼ stroke, with increased compression and overhead valves, the engine has been allowed to turn 2650 r.p.m. at which it develops 70 h.p.

On various test runs with full throttle, the gas consumption was 4 gallons per hour; ¼ pint of oil per hour.

END.

ATTENTION—GLIDER PILOTS

NOW is the time to build the BRIEGLEB UTILITY and walk away with the prize money at the next Elmira Meet.

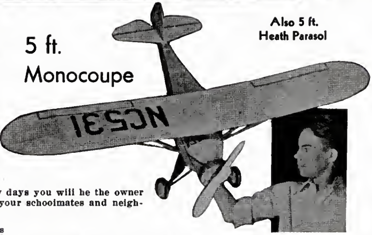
COMPLETE BLUE-PRINTS (64 sheets) for $17.00. Three-view blueprints for 50-cents. Information and pictures sent for 10-cents in coin.

BRIEGLEB AIRCRAFT COMPANY
(Dept. 35)
3234 W. 27th Street, Los Angeles, Calif.

"900 Foot Flights" THEY WRITE
"Fly Like Birds"
From NORTH to SOUTH from EAST to WEST EVERY BODY IS FLYING OUR
5 FOOT SCALE MODELS ACTUALLY The SIZE 1/3 of REAL PLANES!
$1 EACH
PLUS 35c for PACKING, POSTAGE & INSURANCE
●
IF EXPRESS COLLECT SEND ONLY $1.00

5 FT. STINSON RELIANT

Yes Sir—Everybody is flying G. H. Q. planes! The entire country it seems has become Giant Model conscious, if we are to judge by the unprecedented number of people writing us to get them—and then too, letters that are delirious with joy speaking of the real flying achievements of these planes that are actually 1/3 the size of real passenger carrying planes. 30,000 of these models have been sold and built (proof of this in our files)—representing 30,000 enthusiastic endorsers of our planes. Doesn't it thrill you? Imagine! —amazing gigantic models—each a strong outdoor flyer!—$10.00 value for only $1.00. Everything is in the kit INCLUDING ALL LIQUIDS—nothing else to buy! There is no catch! Inspect our kits at any dealer or read for yourself what each kit contains. If you are not convinced that our kits are the biggest values, don't order. If you already realize what bargains our kits are, send your order today and in a few days you will be the owner of a beautiful flying scale model that will make you the envy of your schoolmates and neighborhood.



5 ft. Monocoupe

Also 5 ft. Heath Parasol

CONTENTS: Each of these new G. H. Q. Giant 5 ft. Model Planes contains full size Plans, all ribs, formers and curved parts clearly printed on best grade Balsa. Large bottles Cement and Dope, different colors Japanese Tissue, Special Endurance Rubber, finished Ready-Cut 3" Wheels, Wire, Balsa strips cut to size, Washers and . . . Movable Controls, shock-proof Landing Gear, Scale Details, Lettering, Numbering and Insigniae, Flight Log, etc.

NOTE: We have dealers in almost every city. Visit your dealer first for our kits. If you cannot locate a dealer who can supply you, order direct from us. Send money order, check, stamps, or cash. Send only one dollar if you want express delivery, charges collect.

24 HOUR SERVICE ON ALL ORDERS

Why Are G. H. Q. KITS BEST SELLERS? Hold up to light for Answer!

And Don't Forget These Marvelous G. H. Q. Values:

24" FLYING SCALE MODELS 25c plus 10c packing, postage insurance

Each 24" G. H. Q. Kit is complete in every detail. A liberal quantity of everything. 18 models to select from at 25c each.

Puss Moth
Polish Fighter
Army Falcon
Sopwith Camel
Fokker D-7
SE5
Aeromarine
Army Hawk
Monocoupe
Fairchild "22"
Aeronca
Fokker D-8
Nieuport
Douglas Mailplane
Stinson "R"
Curtiss JN4
Bellanca
Spad
Jap Kawasaki
Russian Fighter

36" FLYING SCALE MODELS 50c plus 20c packing, postage, insurance

G. H. Q. Scale Models are the best Kits your money can buy for appearance and flights. Buy one today and you'll buy a whole fleet of them. Get acquainted with G. H. Q. Kits and no others will do.

36" CURTISS A-8 ATTACK 50c; ALSO 36" NORTHROP GAMMA "SKY CHIEF" 50c 36" DOUGLAS Y-12 50c—COMPLETE IN EVERY DETAIL—

We have a complete line of kits from 10c to $1.00

SEND MONEY ORDER, CHECKS, STAMPS OR CASH. Don't Fail to Include Postage for Each Kit With Your Order. ONE-DAY SERVICE.

G. H. Q. MODEL AIRPLANE CO.
564P Southern Boulevard New York, N. Y.

FREE POSTAGE ON ALL ORDERS IN UNITED STATES FOR 50c OR OVER. EXCEPT WEST OF MISS. ADD 10c. CANADA AND FOREIGN, ADD 15%. UNDER 50c, ADD 15c.
36" Lengths, add 10c for packing.
Send 3c stamp for Illustrated Catalog. Free with orders
NO STAMPS NO C. O. D's.
Add 5c to each check for collection.
No orders accepted for less than 25c.

With all orders for $1.00 or over
2 OZ. CLEAR CEMENT AND
2 SHEETS SILVER TISSUE FREE

Dealers, Clubs, Schools: Send for Price List
20 IN. FLYING PLANS 10c—3 for 25c
Sparrow Hawk, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift L. W., Waco Cabin Biplane Douglas Dolphin, Boeing P-12-F, Fokker D-VII, SE5, Goshawk, Gee Bee.

18 IN. LENGTHS
1/16x1/16......100 for 5c
1/16x1/8....... 35 for 5c
1/8x1/8........ 60 for 5c
1/8x1/4........ 10 for 5c
1/4x1/4........ 5 for 5c
1/2x1/2........ 2 for 5c
18 IN. SHEETS
1/32 or 1/16x2. 8 for 10c
1/6x2 .... 6 for 10c
1/4x2 .... 8 for 9c
3" sheets, double these prices.
18 IN. PLANKS
1x1 1 for 4c|2x2 1 for 18c
1x2 1 for 10c|2x3 1 for 23c
JAPANESE TISSUE
1 doz. all colors, AA- 19c
SILVER TISSUE
20"x24" ....each 5c
SUPER-FINE TISSUE
White only.
Each 5c; doz. 50c
BALSA WHEELS
½"... 3c ¾"... 4c
1" ... 5c 1¼"... 7c
2" ...10c 3" ...17c
BIRCH WHEELS
½"....2c ¾"....3c
1" ....4c 1¼"....5c
2"........10c
DOWELS
1/16x6 dz. 5c ⅛x18 2 for 5c
CLEAR DOPE
1 oz....5c ½ pt....30c
COLORED DOPE
1 oz. bot., all colors...5c
CLEAR CEMENT
1 oz. bot. 5c; 2 oz. bot. 10c
½ pt. bot............35c
BAMBOO
1/16x1/16x12...36 for 5c
1/16x¼x15, ea. 1c; doz. 10c
SHEET CELLULOID
6x8 ...5c 12½x16..20c
CELLULOID WHEELS
¾" pr. 5c 1⅜" pr. 10c
1" pr. 7c 1¾" pr. 17c
3" pair 30c
DUMMY RAD. ENG.
1⅛" d. 16; 2" d. 23; 3" d. 33
ENGINE AND COWL ATTACHED
1⅛" dia. 20; 3" dia. 35
CELLULOID PANTS
½" to 1".........pair 18
1⅜" to 1⅞"......pair 33

INSIGNIA SHEETS
24 insignia and stripes 5c
WASHERS
1 doz. ⅛ or ¼....... 1c
PROPELLER BLOCKS
½x ⅝x 6.......6 for 5c
⅝x1 x 7.......3 for 5c
¾x1 x 8.......3 for 5c
¾x1¼x10.......2 for 5c
¾x1¼x12.......1 for 4c
1 x1½x12.......1 for 7c
1 x1½x15.......1 for 9c
SHEET ALUMINUM
.005 in. thick, 6x6.....5c
.010 in. thick, 6x6.....6c
THRUST BEARINGS
Small, doz. 10c
Large, doz. 15c
RUBBER
1/16x1/16 or .045..16 ft. 5c
1/8 flat ....15 ft. 5c
WOOD VEN. PAPER
20x30 ....1 for 10c
METAL PROPELLERS
2 blades 3 blades
1½"........08 10
2½"........12 15
3½"........18 20
4½"........20 25
Balsa Machine-Cut PROPS
5".... 5c 6".... 6c
7".... 7c 8".... 8c
10"....10c 12"....12c
ALUM. COWLINGS
1⅛" 15; 2" 18; 3" 25
Specify whether anti-drag, closed or open.
BOMBS
¾" 04; 1¼" 07; 3" 12
GUNS WITH RING MOUNT
1¼".....10; 1¾".....15
PURSUIT MACH. GUNS
¾", 1¼", or 1¾", ea. 05
WING AND TAIL LIGHTS
12" 10c; 15" 15c; 24" 20c
WIRE 2 ft. 1c; 25 ft. 10c
MODEL PINS, pkg....5c
THINNERS, 1 oz. bot. 5c
REED, 2 ft......... 1c
BUSHINGS, 1 doz... 3c
SANDPAPER, pkg... 5c
PROP. SHAFTS, doz. 8c
NOSE PLUGS, doz...10c

IMPERIAL MODEL AERO SUPPLY, Dept. A
416 McDonald Ave., Kensington Sta., Brooklyn, N. Y.

See G.H.Q. Ad on preceding page

• They are easy to construct.
• They are complete in every detail.
• Plans are authentic.
• Every kit makes a marvelous outdoor flyer.
• They are low in price.
• Materials are of the best quality only.
• Twenty-four hour service is given on all mail orders.

Finishing

(*Continued from page 266*)

a generous coating under all fittings, and on all parts that butt together. We hope the smell will not overcome you! Heh, heh.

For an outside finish on your floats, aluminum Lionoil is excellent when applied over a red oxide primer. Of the matter of cleaning for painting, we refer you to the beginning of this article. However, be sure the float outsides are painted before any fittings are applied, so you will be sure that there will be paint under all fittings.

Water will collect under fittings and do its damage unnoticed. Paint the undersides of all fittings with bitumastic, and attach while the bitumastic is still wet. Don't use a pyroxilin finish for floats, it won't last anytime. Use a good oil enamel or paint, and get a job that lasts.

Now, we come to the matter of finishing woodwork. For the wing structure, Lionoil brushed or sprayed is about the best. Paint all the wood before the fittings are applied, and give the under surface of fittings, washers, etc., a light coat of bitumastic paint where they bear against the wood. Then give the completely assembled structure, a good heavy coat of Lionoil, being sure to get it in all corners and under the gussets on the ribs.

To thin Lionoil, or to make it dry faster, dilute with high test gas, or a good reducer. Sixty-forty is about right for spraying. To stop the dope from lifting the Lionoil on surfaces that touch the fabric, apply dopeproof paint with a brush, to all painted surfaces upon which the fabric touches. Dopeproof is a white heavy bodied paint, which dries in four hours, brushes out well, and does not lift the dope.

For finishing plywood surfaces, a good sanding with fine paper, then a coat of Lionoil, and two of spar varnish will produce a good lasting finish. Be sure to give the edge grain of the plywood three or four good coats of thin Lionoil, before finishing, or later on you may be surprised to see even the best of plywood curling and coming loose at the edge.

Don't use shellac or lacquers on bare wood and expect to get a lasting or protective finish. It can't be done. Use good oil base finishes, such as Lionoil or varnish, and if you want color, get a good grade of enamel.

By now we are ready to take up the matter of doping and finishing the fabric. Here is where there is much room to spoil the final appearance of the ship, if care is not taken. You can either have a plain finish or a piano finish on your ship, or have something that looks ten times worse than none at all; it all depends on you.

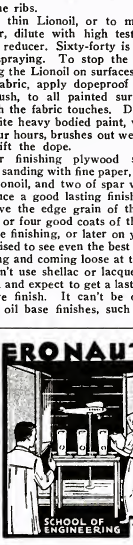
The base of a good durable finish is good fabric. Real grade A mercerized fabric can be obtained for a price that is hardly more than that of unbleached muslin or other such stuff, upon which a good finish is impossible, due to the irregularity of the weave, and roughness of the material. Therefore cover your ship with good mercerized fabric of the proper weight for the type of ship you are building, that is regular weight for ships of the heavy type, and medium weight for ships grossing about six hundred pounds.

First off, we'll tell how to obtain a regular run o' the mill finish, one that will last, and stand lots of inattention without showing it. After you have your surfaces covered and lockstitched, brush on a coat of dope as it comes from the can. Brush it in well, and see that you do it evenly, don't have a puddle here, and none there. This makes rough spots that show up later on, due to some parts having more dope than others. Let dry at least two hours in a temperature of at least seventy degrees, and longer if the temperature is lower.

Before we go further, a word about dope and thinners is in order. You see advertised today dope at prices under a dollar a gallon, and other dope at prices nearly two dollars a gallon, for clear. What's the difference? Well all dope has a certain amount of solid matter in it, and this is what fills the fabric, and gives a good durable finish. The cheap stuff has a smaller amount of solid content, and therefore it requires a lot more of this stuff to fill the fabric, therefore costing as much in the end as good dope, and giving an inferior finish.

Good dope will also tighten better than the cheaper grades, and will give a longer lasting finish. The same story goes for thinners. The best thinner does not help dope, or make it any better, and all thinners to a greater or lesser extent, shorten the life of a dope job.

(*Continued in May issue*)



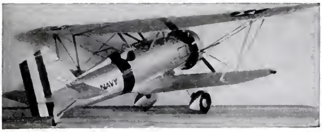
AERONAUTICAL ENGINEERING
DEGREE IN 2 YEARS

• Become an Aeronautical Engineer. Tri-State College course given in 108 weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Equipped with wind-tunnel (see illustration). Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Properly trained engineers in design, research, manufacture and sales work are in demand. Enter March, June, September, January. Courses are offered also in Civil, Electrical, Mechanical, Chemical, Radio and Architectural Engineering; Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. World famous for technical 2-year courses. Graduates successful. Write for catalog.

746 COLLEGE AVE. ANGOLA, IND.

TRI-STATE COLLEGE

NEW CURTISS F11C4 NAVY PURSUIT



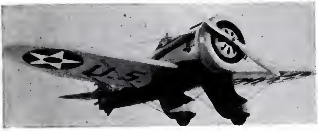
28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 700 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.

Construction Set Complete, postpaid.................................... $4.50

NEW BOEING P26A ARMY FIGHTER

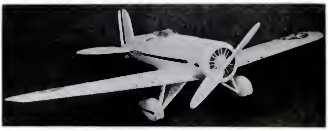


22" Span. Length 17½". Wt. 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3¼" spun tapered aluminum cowl ring, 8" steel type pawlonia wood prop, 1⅜" celluloid wheels, tail wheel, insignias, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.

Const. set in labeled box, postpaid........... .... $2.75

NEW LOCKHEED P23A NAVY FIGHTER



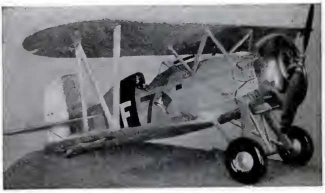
COMBINATION LAND AND SEA PLANE SET

32" Span. Length 22½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 foot rubber, large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.

Construction Set in labeled gift box, postpaid.......................... $2.95

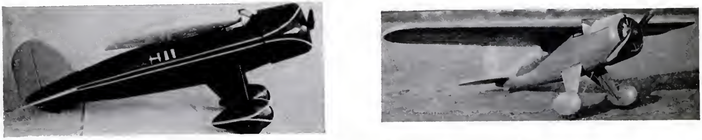
NEW BOEING F4B4 NAVY FIGHTER



22½" Span. Length 14½". Weight 2½ oz. Color, Silver and Yellow

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring. 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set Complete, postpaid............... $2.95**

NEW 41″ LOCKHEED ARMY SPEED VEGA

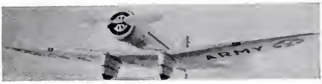


41" Span. Length 28". Wt. 7 oz. Color, army blue and yellow. 1" Scale

This is a sensational new scale model of the latest army Vega. The above photo is of the actual model. Since it is built specially strong, it is practically crash-proof. It will rise from the ground in 10 feet, and fly over 600 feet. It carries many finished parts, making it easy to build. Const. set contains 11" carved steel type pawlonia wood propeller, all parts printed on balsa, ready cut pant cores, 2½" balsa wheels, tail wheel, 4¼" turned motor front, bearing button with bearing, formed wire parts, 24 feet rubber, 3 oz. yellow dope, 2 oz. blue, cement, 2 oz. glue, covering, full size drawing.

Const. set complete in labeled box, postpaid.. $4.95

NEW NORTHROP FT1 NAVY FIGHTER



22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.

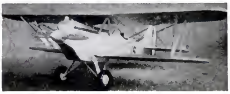
Construction Set Complete, postpaid........ .... $2.00

CATALOG

Send 3c Stamp

This new 1936 8"x 10" catalog shows large photos of all our models including gas motored models, motors, etc. These are the finest and most highly developed model aircraft in the world.

CURTISS F6C3 NAVY FIGHTER



20" Span. Length 14". Wt. 1½ oz.

This is a specially low priced dry set without liquids. Very finely detailed. All parts printed on balsa, celluloid wheels, special exhaust pipes, insignia, drawing, and all parts. **Const. set postpaid........ $1.00**

California Dealer: JAYS MODEL AIRCRAFT, 7763 Melrose Ave., Hollywood, California

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

Lubrication

(*Continued from page 262*)

the Curtiss OX5 engine which was drawn up at the time this engine was manufactured. The oil called for in this engine is not heavier than S.A.E. 30. This will probably be rather a surprise to some of the boys who have been flying their engines with anything from S.A.E. 40 to S.A.E. 80.

A hue and cry will probably go forth that S.A.E. 30 will not stay in this engine. I would suggest, that, if your engine passes oil past the rings with S.A.E. 30 oil, your connecting rods need an adjustment. You need a set of rings whether you are using number 30 or 80 oil because if this engine passes 30 oil you are not getting maximum performance. You will be much surprised at the difference in performance of your engine with just a change to proper lubrication.

Possibly the reason for putting in the heavier oil is due to the fact that most of the airports handle nothing but heavy air-cooled engine oil. Consequently, when you call Bill to change the oil chances are you get the same oil which is specified for a Wright 5 or 6 or some other air-cooled job.

Strange as it may seem, the average motorist today when he drives into a filling station does not ask simply for a quart of oil, but very plainly asks for either a quart of No. 20, 30 or 10 S.A.E. as the specifications may call for on his motor-car and he insists that he gets it.

This motorist has been educated, not only by the manufacturer of his motor car but also by literature and instructions which he receives from the larger oil companies. Needless to say, in the acceptance and use of these instructions, he is most certainly prolonging the life of that car.

Why then should not the private airplane operator pay as much attention to a piece of machinery in which he probably has more money invested than the motor car owner? For the love of Mike, you fellows who are flying OX5's, give her a break and put in the right oil.

In writing these articles both the writer and POPULAR AVIATION have the welfare of the private-owner and operator at heart and both the magazine and I extend to you an invitation to write us your problems, not only of the OX5 engine but of the ship which you are flying or any other type of radial engine which you may be operating.

We wish to make this a practical department of real value to our readers.

END.

FREE CENTRAL'S PHOTOGRAPHIC ALMANAC AND BARGAIN BOOK ◆

CENTRAL BARGAIN BOOK

Explains all the latest developments and methods in Photography and Home Movie Making. Offers hundreds of amazing Bargains in still and movie Cameras, Lenses, Microscopes, Binoculars, Weather Instruments, etc. Used equipment accepted in trade. Satisfaction guaranteed.

Your Free Copy is Ready Now!

CENTRAL CAMERA COMPANY, Est. 1899

230 S. Wabash Ave. Dept. 2784 Chicago, Ill.

SOLID SCALE MODELS

Actual Photograph of the D.E.L. Models

SIKORSKY S-42 Span 17¾"

Kit Complete $1.75

MARTIN "CLIPPER" Span 16¼"

Kit Complete $1.75

Each Kit contains everything required to make a perfect and complete (Balsa) Model. Kits are sent prepaid and insured. Send 3c stamp for illustrated folder.
Remit cash by Money Order. No stamps. No C.O.D.'s.

D. E. L. AERO MODEL WORKS, Dept. B
1616 N. Front St. Philadelphia, Pa.

FREE! 1 DOZ. SHEETS JAP TISSUE or MODEL BUILDER'S KNIFE

WITH ORDERS OF $1 OR MORE

Take advantage of this special FREE offer now! Experience what a real pleasure it is to do business with a model airplane supply house that keeps promises! Every order is shipped same day received! All materials are of highest quality! Prove this to yourself! Learn why so many builders, dealers and clubs deal with SKYWAY! Dealers! Send for prices on Balsa wheels with Brass Bearings

18" BALSA SHEETS
1/32x2, 5 for 6c..10 for 10c
1/16x2, 5 for 6c..10 for 12c
3/32x2, 3 for 5c.. 7 for 10c
⅛x2, 1 for 2c.... 6 for 8c
3/16x2, 1 for 3c.. 3 for 7c
¼x2, 1 for 4c.... 3 for 9c
½x2, 1 for 5c.... 3 for 14c

BALSA PROP BLOCKS
¼x¾x6, 1 for 1c..6 for 5c
½x¾x5, 1 for 1c..5 for 5c
⅝x1x8, 1 for 2c...3 for 5c
¾x1x8 ....2 for 5c
¾x1¼x12, 1 for 3c 2 for 6c
1x1½x12 ....2 for 11c
1x1½x15 ....1 for 7c

18" BALSA LENGTHS
1/16x1/16 ......85 for 5c
1/16x⅛ ....40 for 5c
1/16x3/16 ......20 for 5c
1/16x¼ ....18 for 5c
3/32x3/32 ......35 for 5c
⅛x⅛ ....30 for 5c
¼x¼ .... 6 for 5c
¼x½ .... 4 for 5c
½x½ .... 2 for 5c

18" BALSA PLANKS
1x1, 2 for............ 9c
1x2, 1 for............ 9c
2x2, 1 for............16c
2x3, 1 for............20c
2x6, 1 for............35c

For 36" lengths double above prices and add 10c postage

Bamboo
1/16x12, 40 for 5c
1/16x¼x15
.......6 for 5c
Shredded..40, 5c

Japanese Tissue
All colors,
Doz. 16c

Thinner Best
1 oz. 5c
Sheet Celluloid
2x6 .... 2c
6x8 .... 4c
12x16 ....15c
Clear Dope
1 oz. 5c
½ pt. 25c

Colored Dope
1 oz. 5c
½ pt. 30c
Clear Cement
1 oz. 5c
½ pt. 30c
Wood Veneer
20x30", 1 for 9c
2 for 17c

Reed
1/32, 1/16, ⅛
........3 ft. 1c
Wooden Wheels
½", pair 2c
¾", pair 3c
1", pair 4c
1⅜", pair 5c
1¾", pair 8c
Celluloid Wheels
¾", pair ... 5c
1", pair ... 7c
1⅜", pair ... 9c
1⅞", pair ...15c
Balsa Balloon Wheels
½" ....pr. 2c
¾" ....pr. 3c
1" ....pr. 4c
1⅜" ....pr. 6c
2" ....pr. 8c
3" ....pr. 15c
THRUST BEARINGS 1c
BRUSHES No. 6. 5c

MODEL PINS, Lge. & Sml. 5c pkg.
BUSHINGS, doz. 3c
PROP. SHAFTS
2 for 1c
PAUL-O-WINA JAP PROPS
5" 10c
(add 5c per inch for props up to 10".)
Machine Props
5" 4c
(add 1c per in. for props up to 16".)
Rubber Motors
1/16 sq..20 ft. 5c
⅛ flat ..20 ft. 5c
INSIGNIAS—French, American, English, German
1¼"....4 for 3c
2" 1c
1 sheet of 24, 5c

Dummy Radial Engines
1½" Diam...15c
1⅜" Diam...20c
3" Diam.....25c
DOWELS, 1/6x12,
...10c per doz.
SPOT WELDED HOLLOW ALUMINUM WHEELS
1" ....pr. 6c
1⅜" .....pr. 11c
1⅞" .....pr. 14c
WASHERS,
¼ and
⅛ .....doz. 1c
SANDPAPER,
package 5c
WIRE, 6 ft...3c
36" lengths.
ALUM. LEAF,
2 sheets for 1c
NOSE PLUGS,
large..10c doz.
small ..5c doz.

Send 3c stamp for "Helpful Hints for Model Builders" and catalog for other bargains. FREE with all orders. ORDERS 75c or under 15c postage. Postage prepaid on orders over 75c. West of Mississippi add 10c extra. Canada add 15% extra.
CASH OR MONEY ORDER—NO STAMPS—NO C.O.D.'s.

SKYWAY MODEL AIRCRAFT SUPPLY CO. 383 Seventh Ave., Dept. P
Brooklyn, N. Y.

Stresses

(*Continued from page 260*)

More concretely, the action of gravity tending to bring the plane down and crash it is due to gravitational acceleration. To resist this downward pull and to keep the plane in the air, we must create an equal and opposite force by accelerating a sufficient amount of air with sufficient acceleration in the downward direction. This sums up the whole theory of flight in one short paragraph.

Before we end this first lesson, we must define just one more principle that belongs to this group.

FORCES ARE CREATED IN PAIRS—THE DIRECT ACTING FORCE AND ITS EQUAL AND OPPOSITE RESULTANT FORCE.

In other words, if we apply a force and thus create an acceleration and a stress, there will be an equal force acting in the opposite direction and opposing the first force. The applied force creates an equal and opposite force called its REACTION. If we weigh 180-pounds, for example, this force of 180 pounds acting downward is exactly balanced by the reaction of the floor acting upwards with a force of 180 pounds. For this reason, the member supporting a weight is more commonly known as "the reaction" than as the "support."

In buildings, the foundations act as the "reactions," while in the airplane, the lifting force is the reaction of the weight and is equal to and opposite to the weight. On the ground, the earth is the reaction.

In computing beams, for example, our first step is to compute the value of the reactions acting at the beam supports, and then to use these reactions as the loads on the beam. This is usually more simple and direct than to employ the original loads themselves.

And now we get down to the actual definition of the word STRESS, which was impossible to explain before we understood the meaning of reaction. The load acting on a beam, or other structural member is a force called the load. To prevent this load from rupturing or breaking the beam, the fibers in the beam must provide an equal and opposite reactive resistance to the load.

This reactive force exerted by the fibers or material of the beam is called STRESS. The amount by which the fibers stretch or "give" under the load, measurable in inches, is called the STRAIN. Please remember, fellows, that strain is the deflection caused by stress and is not a force or a load. The stress is given in pounds and the strain is in inches or decimals of inches. Just let this sink in.

END.

MIDGET RACING

Get full details on this thrilling sport; facts for fans, builders and drivers; track sizes and regulations; car specifications, pictures and working drawings. This book also shows and tells all about Indianapolis cars, Miller-Fords and world's fastest car. Brand New AUTOMOBILE RACING, *Fourth Edition*, $1 postpaid, $1.12 C. O. D.; three cents tax if you live in Ohio.

Ray F. Kuns, Dept. 58, Madisonville, Cincinnati, Ohio

CLASS IN METEOROLOGY

RADIO CLASS IN SESSION

PRACTICAL CLASS IN ENGINE SHOP

CLASS IN WELDING AND CABLE SPLICING

CLASS IN MECHANICAL DRAFTING

WRIGHT CYCLONE ON TEST STAND

DAWN PATROL
TRAINING SCHOOL
of Aeronautics

Today the Aviation Industry is *demanding EXPERIENCE.* When YOU become a member of the DAWN PATROL taking a SPARTAN Three ★ ★ ★ STAR Course, your classroom work in theory will be closely scheduled with the application of engineering, radio and welding in the building, maintenance and repair of *actual flying equipment.* SPARTAN has the modern equipment and trained personnel plus the student organization of the DAWN PATROL, all co-ordinating to make your life here interesting and your studies practical, to give the EXPERIENCE *to fit YOU for a place in Aviation.* Send for the new 1936 Catalog of SPARTAN Courses—*the fastest and most economical method of entering Aviation!*

SPARTAN
School of Aeronautics

HOME OF THE 13 DAWN PATROL

SPARTAN SCHOOL OF AERONAUTICS
P. O. BOX 2649, TULSA, OKLAHOMA

GENTLEMEN: Send me a copy of the NEW 1936 Spartan Catalog and Supplement describing in detail Spartan 3 ★ ★ ★ STAR Courses of Aeronautics, tuition and detailed living expenses:

NAME____________________

ADDRESS____________________

CITY__________ STATE__________

AGE_____ Any Previous Flying Experience?__________

Check below branch of aeronautics you are most interested in:

☐ FLYING
☐ MECHANICAL
☐ RADIO-INSTRUMENT
☐ EXECUTIVE-MANAGEMENT

Everything

you could possibly hope for in a MODEL, the BURD has!

● SIZE! ● DETAIL! ● LOW PRICE! ● FLY-ABILITY! ● COMPLETENESS!

Who could ask for more?

5 FT. MODEL $1.50

5 FT. CURTISS ROBIN OR FAIRCHILD "24" (Illustrated) Plus 25c Postage

COMPLETE! Consists of finished Balsa Prop. ALL RIBS CUT OUT READY FOR USE; hardwood wheels; full size plan; direction sheet; plenty of glue, banana oil, colored tissue; special nose block; rubber; wire; washers; reed; and balsa strips cut to size. "A BURD Always Flies!" . . We challenge you to equal this value! . . It's wise to ORDER NOW! Send check or money order!

"It's a BURD"

BURD MODEL AIRPLANE CO.
330 Park Ave., Baltimore, Md.
WRITE DEPT. P. P. R.

Subscribe to

MODEL AIRPLANE NEWS

—the monthly magazine that every model builder recognizes as the authority in the model airplane field. Each month brings new pictures, plans, articles,—all the news about building model airplanes and flying them. Also you won't want to miss the new department devoted to GASOLINE POWERED MODEL AIRPLANES.

1 year $1.65 - 2 yrs. $3.00

This offer good both in the U. S. and Canada.

FREE with each 1 or 2 year subscription:

GET THIS KIT

IT IS FREE

AKRON FIGHTER

A 12" Flying scale model authentically designed. Five of these planes were carried in the ill-fated Dirigible "Akron". Colors: navy yellow and blue with full insignia. Full size plan with all details. 50c value.

Model Airplane News
Div. 914, 551 Fifth Ave., New York

Enclosed find { $1.65 for 1 year / $3.00 for 2 years

subscription to MODEL AIRPLANE NEWS. Send me FREE complete kit to build a flying scale Akron Fighter.

Name ....

Address ....

City .... State ....

Propellers

(Continued from page 252)

inch thick and should be glued with the finest quality of hide-glue or waterproof glue, using a sufficient number of clamps to assure a perfect glue joint between the various laminations. A glue joint at the base-line will save time in making the propeller.

After 24-hours, or more, of drying, layout the projected blade, the same way as before, on the upper surface of the block. Cut out with a band-saw to the required shape. Next, lay out the base-line, the trailing and the leading edges according to the desired outline. The blades are then roughed out by making saw-cuts, followed by chisel and plane. The finishing is by spoke-shave and sand-paper.

The flat-side is finished first and then, with the assistance of the templates, the cambered side is finished. A good direct light, your finger-tips and the glue joints are your best guides for accuracy. The leading and trailing edges should not be made less than 3/32-inch and should be rounded off just before balancing the propeller.

Smoothing the propeller is a safeguard against moisture, and as an additional protection, all glue joints should be examined and filled with glue if openings or cracks appear. Rain water will work havoc with such joints.

To balance the propeller, a hole is drilled in the hub, large enough to hold a ½-inch to 1-inch mandrel, and the mandrel is then rested on two knife edges that have been perfectly leveled before the test begins. That part of the propeller between Stations No. 1 and the hub is the best point to remove material during the balancing process. After the propeller is balanced so that it will come to rest and remain in any position, it is fitted to the engine hub and is given a protective coating of shellac, lacquer or varnish applied to the surface.

END.

Our Readers

(Continued from page 268)

we should have is the use of these immense buildings when they're not being occupied. After all, it's just being practical.

In conclusion, I urge you, on behalf of the multitude of dissatisfied model builders, to do everything in your power to bring about an "O.K." from the proper authorities. In this manner, we wouldn't have to depend just on the favorable days of the summertime in which to carry on our activities.

BILL RHODE, 350 Griggs Ave., Teaneck, N. J., writes a short but welcome letter in regard to some of the old-timers. Mr. Rhode, you no doubt remember, is the author of the Gates Flying Circus stories that have appeared in past issues and which are likely to reappear in an early issue. Here he is:

Another old Gates Circus pilot died a short time ago—Okey Bevins, who was killed in a crash in Akron, Ohio. Okey was flying in a fog out of Cleveland and came down to 200 feet above Mason City, crashing into a radio tower of the Crosley Radio Corporation.

Thus, each year since 1927, at least one of Gates' old pilots has been killed every year. Let's hope that 1936 will not be in the lineup. It seems strange that men survived the hazardous stunt flying of the circus only to crash and die on simpler and apparently saner flights.

One reader wished to get the details of Buck Steele's death and here they are: Buck was on a night fireworks flight with Frank Ashcraft and Buck was lighting the flash bombs with a cigar he was smoking. According to all reports, he threw his cigar overboard instead of the bomb, holding the latter in his hand until it exploded and killed both men.

This is certainly a peculiar accident but is not the only accident of that sort that has occurred up to date. There is a Chicago pilot, Jack Harkness, who forgot to toss a star bomb overboard with the result that he has only one finger left on his right hand.

END.

★ **HELP WANTED**

We will employ a limited number of A-1 representatives, principally in Southern and Western states, who can qualify to sell our complete list of Used Planes and Accessories.

Liberal commissions offered. References required.

Send full particulars about yourself and planes for sale in your neighborhood.

Address:
Major H. H. Woeltjen
Manager, Used Plane Division

Aviation Products Co.
619 S. Federal St., Chicago

Don't Buy Any More KITS

'till you see our latest catalog!

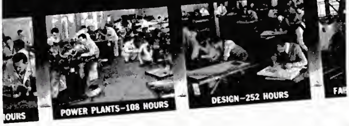
We manufacture, you know, the world's largest line of beautiful authentic models in two scales; popularly priced kits at 25c to 85c complete except for liquids and super-complete (with liquids) 98c to $3.75 kits, as well as several larger numbers.

BIG SURPRISE!

NOW READY! Our new 20" line just out comprising kits of "Mr. Mulligan", Hawk P8-E and Fokker D-7 are absolutely complete but without liquids, 50c each. **Ready March 16,** Howard Hughes, (World Record breaking) SPECIAL Racer, kit, less liquids, 75c. Send 3c stamp for catalog today.

CLEVELAND
MODEL & SUPPLY CO., Inc.
"The Line that really Wins the Prizes"
1866PA West 57th St., CLEVELAND, OHIO, U. S. A.

Boeing School
"AIRLINE OPERATIONS"
COURSE



3372 *Hours* of Theory and Practice

Boeing School's 24-month "Airline Operations" course offers a thorough preparation for communications, metals, instruments, engines, electrical, sales, and administrative work . . . a sound background for such jobs as assistant field manager, field clerk, traffic man.

At Boeing School, instruction is based directly on the actual practice of United Air Lines with its 55 million miles of experience.

Moreover, as a division of United, Boeing School is in a key position to prepare you for the *coming developments* in construction and maintenance.

And at *this school* you get more hours of personal instruction. Boeing School's staff includes more licensed ground instructors than any other air school in the country.

Outstanding, too, are the laboratories and 7 shops you work in: Engines, Woodworking, Welding & Metals, Fabrication & Design, Radio, Instruments, Maintenance.

Three ground courses: 9-month "Airline Technician"; 12-month "Airline Mechanics"—and the 24-month "Airline Operations" course, the most complete ground training offered by Boeing School. This course gives you a thorough grasp of a wide range of subjects in Aerodynamics, Design, Meteorography, Power Plants, Instruments, Fabrications, Metallurgy, Materials, Communications, and Airline Operations.

Send for 1936 Bulletin

There's a Boeing School course to prepare you for any field of aeronautics. The new *Bulletin* describes ground and air courses, gives costs and enrollment requirements. Mail coupon below for your copy today.

SEVEN PILOT COURSES
Boeing School Pilot courses are outstanding. The 2-year "Airline Pilot and Operations" course is considered the most complete in America. Send coupon for details.

Next regular enrollment March 30

BOEING SCHOOL OF AERONAUTICS A division of UNITED AIR LINES

Department Q-4, Airport, Oakland, California.
Gentlemen: Without obligation, send me NEW 1936 Boeing School Bulletin, giving complete information on courses indicated:

☐ Airline Pilot and Operations
☐ Airline Pilot
☐ Transport Pilot
☐ Limited Comm'l Pilot
☐ Private Pilot
☐ Amateur Pilot
☐ Airline Mechanic
☐ Airline Operations
☐ Airline Technician (For engineering graduates only)
☐ Special Airline Pilot (For Transport Pilots only)
☐ Home Study Courses (For those employed in the industry)

Name ________ *Age* ________
Years in High School ________ *Years in College* ________
Address ________ *Phone* ________
City ________ *State* ________

BOEING SCHOOL'S 12-Month "AIRLINE MECHANIC" course covers 39 SUBJECTS

This basic course prepares you for many types of jobs at airports, factories and on the lines

You get a *greater breadth of experience* at Boeing School.

Back of this school stands United Air Lines—with its 95,000,000 miles of air transport experience. And in United's adjoining shops you can watch the practical application of your training.

Your instructors are specialists with from 10 to 24 years of experience in the industry. And they are able to give you *more hours of individual attention.* (Boeing School's staff includes more licensed ground instructors than any other air school in the country.)

In the "Airline Mechanic"—one of 4 ground courses—you cover *theory* in classrooms and laboratories; practical work in 7 modern shops: Radio, Maintenance, Power Plants, Woodworking, Welding & Metals, Fabrication & Design, and Instruments. You become familiar with industry practice through actual hangar service at Boeing School.

Write today for NEW Bulletin

The 1936 Boeing School Bulletin describes ground and air courses. Outlines costs and enrollment requirements.

Put the coupon below in the mail today.

SEVEN PILOT COURSES
Boeing School Pilot courses are outstanding. The 2-year "Airline Pilot and Operations" course is considered the most complete in America. Send coupon for details.

Next regular enrollment March 30

BOEING SCHOOL OF AERONAUTICS A division of UNITED AIR LINES

Department Q-4, Airport, Oakland, California
Gentlemen: Without obligation, send me NEW 1936 Boeing School Bulletin, giving full information on courses indicated:

☐ Airline Pilot and Operations
☐ Airline Pilot
☐ Transport Pilot
☐ Limited Comm'l Pilot
☐ Private Pilot
☐ Amateur Pilot
☐ Airline Mechanic
☐ Airline Operations
☐ Airline Technician (For engineering graduates only)
☐ Special Airline Pilot (For Transport Pilots only)
☐ Home Study Courses (For those in the industry)

Name ________ *Age* ________
Years in High School ________ *Years in College* ________
Address ________ *Phone* ________
City ________ *State* ________

An Airy Chat with the Editor

(*Continued from page 236*)

broken the world's record for bicep power aircraft. Don't be bashful, let's hear about it.

* * *

TIMES are improving. All during the depression we have failed to get a single contribution telling us that old, old story about the pilot who landed in the cow pasture and then had that thrilling interview with the cow's husband. Not one word of this tale all during the hard times, and even with everybody in the United States writing aviation stories and sending them into old P. A.

But we've turned the corner, brother. We have received three of these rubber-stamp elegies within the past two weeks. Even our good friend, Joan Thomas, sent that old one from Paris about the guy who built a flying flea in the basement and then had to tear down the house before he could get the flea out into the fresh air. Shame—shame, Joan.

* * *

WE feel so refreshed over the cow-pasture incident that we intend to reciprocate by turning the photo of that old damaged Nieuport loose in our columns once more. Every time that we feel gay, in goes the picture of the bunged up Nieuport and right back comes a flock of letters from vets who claim that that is the ship they flew during the war. We get a lot of kick out of this for more than twenty men have already given thrilling descriptions of the battle scarred Nieuport.

* * *

WE have your interest at heart—deeply. We want you to save your money; hence, we will give you this little tip. In Our Reader's column, and in the club columns, we give you the name and address of the person connected with that particular notice. If you wish to correspond with this person—there you are.

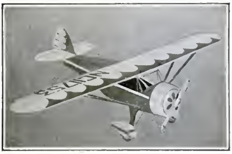
But, in a few cases, we have not received the name or address of the person referred to. In some cases they do not even sign their names. Therefore, it will do no good for you to ask us for the name or address. Again, if only the name of a small town is given, it is likely that such a town has no street number system and it will be sufficient to simply address the letter to the town.

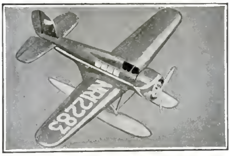
* * *

AND one thing more before we stop. Authors and photographers, please put your name and address at the head of your manuscript and on the back of your photos. This cooperation will save trouble for both of us. So long.

J. B. R.

SMASHING VALUES!





NEW 36" Monocoupe with Movable Controls

High as the Stratosphere in quality! A sensation with model builders. A flying model that has broken all records. Accurately designed by our engineers after months of planning. Looks just like a real plane when in the air. Complete Kit contains finished aluminum cowl, carved prop, all supplies, accessories, and the famous HEATHE copyrighted and simplified plans. Be the first to fly this new HEATHE mistress of the skies! $1.25—postage 25c extra.

$1.00 Postage 25c Extra

FREE PHOTO of Will Rogers and Wiley Post taking off

You'll want one of these famous photos, size 5x7, suitable for framing. Get yours FREE with a purchase of $1.00 worth of kits. Quantity is limited so rush your order—today. May be purchased (without additional order) for 20c postpaid.

EXACT REPLICA FAMOUS Will Rogers—Wiley Post Lockheed Model

You'll want to build this 36" record breaking flyer as a memento! Duplicated in every detail. Each kit contains the famous new HEATHE copyrighted, simplified plans and instruction sheets. All parts printed on balsa. Optional supplies for movable controls from the cockpit, carved prop, finished aluminum cowling, etc., etc. May be flown as a land plane. $1.50—postage 25c extra.

$1.50 Postage 25c Extra

For Quality and Value Heathe's Supplies Lead!

No model is better than the materials from which it is made. That is why HEATHE sells only first quality, tested and proven supplies. No junk; no seconds; no inferior quality. When you buy from Heathe you're satisfied—and you always buy at lowest possible prices! Get our New 1936 Catalog—Just off the press. Crammed with bargains.

SENSATIONAL! SPECIAL!

6-INCH SOLID MODELS
Complete in all respects, plus booklet "3-E-Z Steps to Model Building." Your choice of the following models: Gamma, Sped, Lockheed Vega, S.E.5, Fokker DV11, Boeing P-12-F. 8 for 25c postpaid.
3 for 25c

15-INCH FLYING MODELS WITH MOVABLE CONTROLS
Complete with adjustable pitch prop, etc. Choice of the following: Weco Teperwing, Greet Lakes Trainer, Ben Howerd's "Ike", Fokker DVI1, Northrop Fighter, and Douglas Gull Wing. 2 for 35c postpaid.
2 for 35c

If 36" lengths are desired, just double 18" price and add 10c extra postage to order.

18" BALSA STRIPS
1/10x1/16 50 for .03
1/16x1/8 28 for .05
1/16x3/16 20 for .05
3/32x3/32 21 for .03
1/0x1/0 20 for .03
1/0x3/16 14 for .03
1/8x1/4 10 for .05
3/10x8/16 10 for .05
1/4x1/4 6 for .05
1/2x1/2 3 for .03

18" BALSA SHEETS
1/64 x 2....3 for .10
1/82 x 2....7 for .10
1/10 x 2....7 for .10
3/32 x 2....6 for .10
1/0 x 2....5 for .10
3/16 x 2....4 for .12
1/4 x 2....3 for .11
1/2 x 2....2 for .12
(For 3"x18" double 2" width cost.)

FREE
With every order of $1.50 or over, 250 ft. of the finest fresh ⅛ flat Para Rubber, free. Add 10c for handling charge of Free Rubber. Free supplies with all other orders.

18" BALSA PLANKS
1" x1" ...1 for .07
1" x1½" ...1 for .09
1" x2" ...1 for .11
1" x3" ...1 for .13
2" x2" ...1 for .20
2" x3" ...1 for .25

BALSA PROPELLER BLOCKS
½x ¾x 5 ..7 for .05
½x ¾x 0 ..7 for .05
⅝x1 x 7 ..3 for .05
¾x1 x 8 ..2 for .05
¾x1¼x10 ..1 for .04
¾x1¼x12 ..1 for .05
1 x1½x12 ..1 for .07
1 x1½x15 ..1 for .08

RUBBER
1/32 sq. 30 ft. for .05
.043 sq. 20 ft. for .05
3/32 flat 20 ft. for .05
1/8 flat 17 ft. for .05
3/16 flat 12 ft. for .05

COLORLESS CEMENT
1 oz....05 2 oz....06
4 oz....15 1 pt....50

CLEAR DOPE OR BANANA OIL
1 oz....05 2 oz....07
4 oz....18 1 pt....45
Thinner same price as clear dope

COLORED DOPE
White, yellow, orange, blue, red, green, olive drab, black, silver gold.
1 oz....06 2 oz....10
4 oz....19 1 pt....65

JAPANESE TISSUE
White, per doz.....13
Colored, asst., per doz., all colors...20

SILVER TISSUE
20"x24" .....each .05

TURNED BALSA WHEELS
Prices per pr.
½"...03 ¾"...04
1"...05 1⅜"...07
1¾"...12 3" ...20

CELLULOID WHEELS
Prices per pr.
¾"...05 1" ...07
1⅜"...16 1¾"...16

SUPER-FINE TISSUE
White Only.
Sheet, 5c; dozen, 50c

BAMBOO
1/16 sq. x 14
35 for .05
1/16 x 1/4 x 11
1 for .01
1/10 x 1/4 x 11
1 doz. for .07

REED
1/32 or 1/16
0 ft. for .02
3/32 or 1/0
5 ft. for .02

WASHERS
(⅛ or ¼ dia.)
1 doz. .01 1 gross .13

WIRE
Straight Lengths
Nos. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, or 16,
6 ft. for..........03

SANDPAPER
5 large sheets.....05

DOWELS
1/10"x12" doz. .06
1/0"x18" 6 for .05
3/16"x18" 4 for .05
¼"x18" 3 for .05

SHEET ALUMINUM
Prices per sq. ft.
.002 thick....... .08
.005 thick....... .10
.010 thick....... .17

THRUST BEARINGS
Small or large, 2c each, or 15c per doz.

DUMMY RADIAL ENGINES
Celluloid, 9 Cylinders,
1⅓" diam........ .18
2" diam........ .23
3" diam........ .34

ALUMINUM TUBING
Per Ft.
1/16...09 3/32...07
1/0 ...07 1/4 ...10

TURNED HARD WOOD WHEELS
Per Pr.
½" diam. .... .02
¾" diam. .... .03
1" diam. .... .03
1⅜" diam. .... .05
1¾" diam. .... .07
2½" diam. .... .10

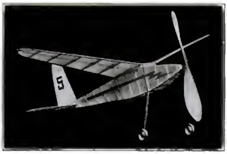
INSIGNIA SHEET
12 pr. and rudder and tail markings with gummed back.
Each .... .05

MODEL PINS
Package of 100.. .05

How to Order—
Add 15c to orders under $1.50. Orders over $1.50 add 10% of order. Canada 10c extra. 36" lengths 10c extra. Add 10c for packing charge of free rubber.

HEATHE MODEL AIRPLANE CO.
438A4 East 98th Street BROOKLYN, N. Y.

CHAMPIONS



For Real Flights
CADET MAJOR—CADET Jr.,
Span 30" Span 20"
Area 102 Sq. In. Area 43 Sq. In.

We are proud to present the CADETS. The CADET MAJOR, a fast climbing high altitude soaring airplane with remarkable duration. The CADET Jr., a snappy pursuit style performance airplane with excellent duration. The latest Bunch designs from truly—The Home of Championship Airplanes—Last week at the big Los Angeles Junior Birdmen Indoor contest, every prize was won by airplanes built of Bunch material. These Model Builders are champions because they know what is best. Donahue, the Grand Prize Winner, says to you, "I buy Bunch material. Their uniform high quality enabled me to do the consistent flying that won. I can truly recommend the CADETS."

CADET MAJOR Kit................Postpaid $1.50
CADET Jr., Kit..............30c Plus 10c Postage
Both Kits, Postpaid...........................$2.00

Catalogue 3c stamp

BUNCH MODEL AIRPLANE CO.
2303 S. Hoover St. Los Angeles, Calif.

Dallas Aviation School and Air College

LOVE FIELD *A Government Approved School — Established 1926* DALLAS, TEXAS

WE HAVE WHAT IT TAKES

Here Is One Aviation School That Turns Out Good Pilots • Expert Mechanics • Real Craftsmen

12 Courses Par Excellence

In our ships and shops are 30 motors, all radial air cooled, ranging in capacity from 100 to 450 hp.

We give our students MORE hours in the air with each flying course. More hours per dollar—more training per hour.

12 of the Nation's Best Airplanes

All Types . . . . 2 to 14 Place

55,000 Square Feet

of floor space in our buildings are devoted to school purposes.

Complete classroom and shop instruction with all flying courses—more and better mechanical training with ALL courses.

Our plant consists of five hangars, 11 shops and laboratories, five classrooms, five dormitories, and cafe. We *have* what we advertise!

268 Acres

as level as a floor, with hard surfaced runways, elaborate lighting system, all commercial airport facilities — that's Love Field!

IF YOU ARE INTERESTED

We are anxious to place full details of our school before you. Our NEW TEXAS CENTENNIAL 1936 SPRING CATALOG is just off the press. Full and complete information is given covering all courses in detail. Our prices are exceedingly low. Our school is located right. Our training is second to none.

Dallas Aviation School
And Air College
LOVE FIELD DALLAS, TEXAS

USE THIS COUPON

Dallas Aviation School and Air College,
Love Field, Dallas, Texas.

Gentlemen: Send the new 1935-36 Catalog and information on the course checked.

- ☐ Master Airman and Transport Pilots Course
- ☐ Transport Pilots Course
- ☐ Limited Commercial Pilots Course
- ☐ Private Pilots Course
- ☐ Amateur Pilots Course
- ☐ Advanced Aviation and Mechanics Course
- ☐ Master Mechanics Course
- ☐ Aircraft Instruments Course
- ☐ Radio Service and Repair
- ☐ Combined Limited Commercial and Advanced Aviation and Mechanics
- ☐ Combined Private Pilots and Advanced Aviation and Mechanics
- ☐ Combined Private Pilots and Master Mechanics
- ☐ Combined Amateur Pilot and Advanced Aviation and Mechanics
- ☐ Combined Amateur Pilot and Master Mechanics

Name ....

Address ....

City ....

State ....

Books

(*Continued from page 250*)

able as a dictionary. The items on *photography, paints, oils, explosives, dyes, adhesives, etc., are very complete.* Old formulas have been modified and revised by a staff of authorities.

LAST FLIGHT by Barbara Hall, Dodd, Mead and Company, Inc., 1936, $1.50.

A poignant story of a flyer whose life was active, dramatic and widely publicized. All his interests were wrapped up in his vocation and his only love was that of the glorious sensation of solo flight. It is an interesting and well told story.

END.

Northwest

(*Continued from page 240*)

ond, Bain radios his position and gets his okay from Spokane. The Ohio, Illinois or Indiana farmer, who sets his watch by the passing airliners, is replaced in the Pacific Northwest by the lonely sheep herder and miner. They look forward to the appearance of the high flying airliner.

The closely grouped night flying beacons are easily seen beneath the ship. On a clear night, when flying high over the mountains as many as ten of these beacons can be seen strung along the route ahead of the pilot. Although it is true that some of the most primitive, unexplored territory on the North American continent is in this section of the country, there are emergency airports kept clear along the entire route through the mountains.

Gradually sloping down toward the final leg to Spokane, Len Ashwell leaves his passenger-audience to prepare for the changes at that division point . . . he will fly on to Seattle, his home. Bain, however, lives in Spokane, his division terminal. First pilots are permitted only to fly the Billings-Spokane division but co-pilots may also fly the Spokane-Seattle run if they wish.

Nearing Spokane, the radio beam range narrows down. Pilots flying blind know when they have passed over a beam broadcasting station by a silent zone lasting for a short interval. Just preceding the zone of silence, the beam narrows to a point where slightest deviations from direct course register immediately. At its widest point the radio beam covers approximately a 25-mile area.

The projection of the beam is a conical path that spreads like the beam from a headlight.

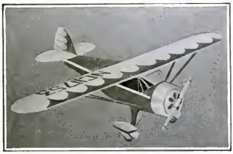
Coeur d'Alene's emergency airport slips to the right, Jack Bain slowly throttles down though the airliner maintains its speed by its gradual glide earthward. The transmitter clicks . . . Bain and Ashwell are asking Spokane if the field is clear to come in. They get the airport operator's okay, landing-gear is lowered and the Electra sinks steadily and comfortably onto the valley airport at Spokane, the liner's first stop in Washington. Chicago is slightly less than ten hours behind.

Tremendous distance, any way that you choose to look at it. The mighty motors stand silently after possibly a million revolutions—or more—and are still good for further millions of turns. Space means nothing to us now—for that has been defeated by air-travel.

Pilot Bain says goodbye to his passengers and introduces W.P.A. "Bill" Straith, one of America's three ace mountain flyers. Short, quiet and looking like almost anything except an ace airline pilot, Bill Straith flies the Spokane-Seattle division exclusively. Only two others are his equals on that divi-

(*Continued on page 296*)

DEALERS ATTENTION!
Here are SPARKLING VALUES from DIAMOND!



36" SCALECRAFT FLYERS
MONOCOUPE
For quick turn over and fast profits stock this flying model. It's the sensation of the industry! Painstakingly designed by Diamond engineers. Features movable cockpit control! Complete with copyrighted, simplified plans and all supplies and accessories! $1.00, postage 25c extra. $1.00
Also Post-Rogers Lockheed—36" flyer: $1:50, postage 25c extra
DEALERS—WRITE FOR SPECIAL DISCOUNT ON QUANTITIES

★ ★ ★ FREE DEAL ★ ★ ★
A Big Bonus for a Limited Time Only!
With each order for $2.50 or more of supplies we give free skein of para rubber; regular wholesale price 40c; retail value $1.40 FREE! With each order for $5.00 or more of supplies we give Free—1 skin of para rubber and 2 dozen large insignia sheets. Wholesale price $1.17; retail value about $4.00.

FREE PHOTO
ROGERS & POST TAKING OFF
with ill-fated Lockheed at Fairbanks, Alaska. Size 5x7, suitable for framing. FREE with every scalecraft flyer Kit.

SUPPLIES AT LOWEST WHOLESALE PRICES!

If 18" lengths are desired, take ½ of 36" length price.
If 3" widths are desired, double price of 2" widths sheet Balsa.
Thinner same price as clear dope.
BALSA 36" LENGTHS PER 100
1/32x1/16 ....10c
1/16x1/16 ....10c
1/16x3/32 ....18c
1/10x1/8 ....19c
1/16x3/16 ....24c
1/16x1/4 ....28c
1/6x1/2 ....60c
3/32x3/32 ....24c
1/8x1/8 ....29c
1/8x3/10 ....48c
1/8x1/4 ....52c
3/16x3/16 ....65c
1/4x1/4 ....80c
1/4x1/2 ....$1.50
1/2x1/2 .... 2.15
CARVED BALSA PROPS Per doz.
5" 30c
6" 38c
8" 50c
10" 65c
36" SHEETS
1/04x2 ....10 for 14c
1/32x2 ....10 for 14c
1/16x2 ....10 for 17c
3/32x2 ....10 for 20c
1/8x2 ....10 for 22c
3/16x2 ....10 for 31c
1/4x2 ....10 for 40c
BALSA PLANKS 36" Lengths
1x1, each 8c
1x1½, each 8c
1x2, each 15c
1x3, each 20c
1x6, each 35c
1½x1½, each ...25c
2x2, each 25c
2x3, each 35c
2x4, each 45c
2x6, each 66c
3x6, each $1.25
COLORLESS CEMENT
1-oz. bots., ½ doz.23c
2-oz. bots., ½ doz.40c
4-oz. bots., ½ doz.70c
1 pt., each........45c
1 qt., each........75c
1 gallon, each...$2.00
CLEAR DOPE OR BANANA OIL
1-oz. bots., ½ doz.23c
2-oz. bots., ½ doz.40c
4-oz. bots., ½ doz.70c
1 pt., each........40c
1 qt., each........65c
1 gal., each......$1.75
Thinner same price as clear dope.
JAPANESE TISSUE
White, per doz...12c
Colored, asst., per doz. 15c
All colors.
Silver, per doz...21c
STANDARD PITCH BALSA PROPELLER BLOCKS Per Dozen
⅝x½x5 .... 5c
½x¾x5 .... 5c
½x¾x6 .... 8c
⅝x1x7 ....14c
¾x1x8 ....18c
⅞x1x9 ....25c
¾x1¼x10 ....30c
¾x1¼x12 ....35c
1x1½x12 ....40c
1x1½x15 ....55c
BAMBOO
1/10 sq. x 14, 1 gross for........20c
1/16x¼x11, 1 doz. for 5c
REED
1/32 or 1/10 dia., 50 ft. for......18c
3/32 or ⅛ dia., 50 ft. for 20c
ALUMINUM COWLING
Closed or Open
1½" dia., 3 for...25c
2" dia., 3 for...35c
2½" dia., 3 for...43c
3" dia., 3 for...55c
4" dia., 3 for...80c
HOW TO ORDER
No orders under $2.50 . . . all orders shipped express collect.
FRESH PARA RUBBER AAA GRADE
Per 225' skein
1/32 sq. 25c
.045 sq. 35c
3/32 flat 35c
1/0 flat 40c
3/10 flat 70c
Lb., any size...$1.00
REED
1/32 or 1/16 dia., 50 ft. for.......18c
3/32 or 1/8 dia., 50 ft. for.......20c
SHEET CELLULOID
(Transparent)
13½x16, each.....19c
0x8, doz. 65c
INSIGNIA SHEET
12 pr. & rudder and tail markings with gummed back.
Doz., 38c; 100, $1.73
DUMMY RADIAL ENGINES
(Celluloid, 9 cylinders)
1½" dia., ½ doz. for 80c
2" dia., 3 for.....65c
3" dia., 3 for.....65c
3" DIA. CELLULOID MOTOR AND DRAG RING COMBINED
(First time on market.)
Special price, 3 for $1.00
NOSEPLUGS, HARDWOOD
1 doz. 5c
100 ....40c
CELLULOID WHEELS
¾" dia., per doz.24c
1" dia., per doz.25c
1⅜" dia., per doz.35c
1⅞" dia., per doz.60c
BALSA BALLOON WHEELS
(Machine Turned)
½" dia., per doz. 9c
¾" dia., per doz.11c
1" dia., per doz.14c
1⅜" dia., per doz.19c
1⅞" dia., per doz.38c
3" dia., per doz.05c
BIRCH WHEELS LIGHT AND STRONG
½".....per doz. 5c
¾".....per doz. 8c
1".....per doz. 8c
1⅜".....per doz. 10c
1⅞".....per doz. 15c
BRASS BUSHINGS OR EYELETS
1/16 diam...per 100, 12c
3/32 diam...per 100, 15c
1/8 diam....per 100, 18c
THRUST BEARINGS
(Hard Steel)
Small, per dozen...... 6c
Small, per gross......55c
Large, per dozen...... 7c
Large, per gross......70c
WIRE, PER 100 FT.
(Straight Lengths)
No. 6 ....15c
No. 8 ....18c
No. 10 ....20c
No. 12 ....23c
No. 14 ....26c
WASHERS PER 100
⅛ brass O. D. 5c
¼ copper O. D.........5c
SHEET ALUMINUM
.002 thick, 5 ft. for...35c
.005 thick, 5 ft. for...50c
.010 thick, 5 ft. for...75c
ALUMINUM TUBING
(Special 1/100" wall)
1/16 O.D., 5 ft. 30c
3/32 O.D., 5 ft. 32c
1/8 O.D., 5 ft. 32c
3/16 O.D., 5 ft. 40c
1/4 O.D., 5 ft. 45c
COLORED DOPE
White, yellow, orange, blue, red, green, olive, drab, black, silver, gold or gray.
1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, per ½ doz. $1.00
1 pt., each........50c
1 qt., each........85c
1 gallon, each......$2.25
SANDPAPER
5 Pieces to the Pack
Per doz. pkgs........25c

SEND FOR OUR CATALOG OF SMASHING VALUES
◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆ ◆
DIAMOND
Model Mfg. Supply Co.
915A4 Saratoga Av. Brooklyn, N. Y.
GET THE FACTS ON OUR NEW 10c LINE OF KITS!

FUTURE FLYERS OF AMERICA!
● Write me for complete information on how to join the Future Flyers of America — a live and growing organization of future men of the air!
KEEP UP TO DATE—INFORMATION ON REQUEST. GIVE AGE.
PILOT JOHN W. HUFF, 926 N. BLVD., OAK PARK, ILL.

★ Used AIRCRAFT and Equipment ★

Now is your chance to buy a GOOD USED plane with an Aviation Products guarantee. Full details are immediately available on all planes listed. All planes subject to prior sale so write, wire, or phone at once if interested.

Note These are a few of the outstanding bargains we have for sale. If you cannot find the airplane you desire in this listing, write us, giving full details of the type and model, and the price you intend to pay. We will then endeavor to find a plane to suit your needs.

AERONCA C-3.

1 Passenger open type, powered with Aeronca E113, 36 H. P. engine. Total hours flown; 1100—70 hours since last general overhaul by licensed mechanic. Fabric practically new. General condition of plane and engine good. Equipped with standard instruments and Flotorp propeller. A real buy. $875.00.

LINCOLN PRIMARY TRAINER.

Similar to one shown in photo. Powered with Kinner K5—100 H. P. engine. Licensed to April, 1936. 2-place open land Biplane. Total hours logged, 875—10 hours since last general overhaul by approved repair station. This plane has been completely rebuilt, recovered, and looks like new. Oleo shock absorbers on landing gear, standard instruments, and Gardner wood propeller. Terms cash but can be financed. $1200.00.

FAIRCHILD KR 21B.

Powered with Kinner 125 H. P., B5 engine. 2-passenger open Biplane. Total hours flown; 325—20 hours since last top overhaul. Licensed to October, 1936. Condition of plane and fabric excellent and looks like new. Dual control. Oleo shock absorbers, wheel brakes, standard instruments, Gardner wood propeller. Terms cash but can be financed. $1635.00.

FAIRCHILD KR 34 C.

Similar to one shown in photo. 3-POLB. Powered with Wright J-6-5 engine. Licensed to July, 1936. Total hours; 700 on engine and plane—114 hours since last general overhaul. Condition of plane and fabric is excellent. Inertia starter, compass, tachometer, altimeter, bank and turn indicator, rate of climb indicator, navigation lights, Hamilton steel propeller, Stromberg carbureter, Scintilla Magnetos. Hydraulic shock absorbers and mechanical brakes. Formerly cost $5300.00. Now $1320.00 fly away, or will deliver for expenses.

LAIRD LC-B200.

Standard series. 3-POLB. Powered with Wright J-5—220 H. P. engine. Total hours flown, 465—155 hours since last general overhaul. Standard instruments, including airspeed, compass and clock, Bendix brakes, Triplex windshield, metal front cockpit cover, etc. Plane and engine in excellent flying condition. Original price $10,350.00. Sacrificed at only $2000.00. Exceptional value. Terms cash or 1/3 down, balance 12 payments plus charges.

LAIRD LC-DR JUNIOR SPEEDWING.

Powered with Inverted Ranger 6-390, 140 H. P. engine. Single Seater Open Land Biplane. Top speed 170 M.P.H. Has a total time of only 43 hours and is in perfect condition. N. R. license. Original price $6000.00. For quick disposal $2470.00 flyaway. Price cash but can be bought at 1/3 down, balance in 12 payments plus financing charges. A wonderful bargain for a small price. It's a LAIRD. "nuff" said!

WACO 10 GXE-OX5. Two front spars cracked on one side. condition otherwise very good. Less than 500 hours flying time; 30 hours since last overhaul. Eligible for license when repaired. Standard instruments and special handmade Artificial Horizon. Estimated cost of repairs $125.00 to $150.00. This is a real bargain, priced for quick disposal at $285.00.

LAIRD LC-IB 300.

Standard series. 3-Place Open Land Biplane. Powered with J-6-9, 330 H. P. Wright Whirlwind. Licensed. Equipped for general and special flying. Has airspeed, rate of climb, Thermo-couple, Ice warning and turn and bank indicators, besides other instruments. Speed Ring, Bendix brakes, cockpit heaters, Triplex windshield, etc. Plane and engine in excellent condition. Original price $11,850.00. Now only $3130.00. Terms cash or 1/3 down, balance 12 payments plus charges.

AMERICAN EAGLE. Model 101. Powered with Curtiss OX5—3POLB. Total hours flown 138 and only 2 hours since general overhaul by licensed mechanic. Standard instruments. Plane and engine in excellent condition. Identified but eligible for license. Terms: $350.00 cash, flyaway.

Special Bargains!

A few real buys that can be
had if you act quickly

1934 AERONCA C-3. 2-place convertible cabin. 36 H. P. Aeronca engine. Licensed to November, 1936. Total hours 380, 40 since last general overhaul by factory. Perfect condition. $1400.00 flyaway.

1930 CURTISS ROBIN, Challenger motored. 650 hours total time. Licensed and flying. $1050.00 flyaway.

1635 TAYLOR CUB, Continental 40. 346 hours total time. Licensed and flying. $1450.00 flyaway.

1929 COMMANO AIRE. J-6-5 Whirlwind. 640 hours total time. $1250.00 flyaway.

2TIA GREAT LAKES. Cirrus, perfect condition. Just overhauled completely. A real buy for $1235.00 flyaway.

STINSON TRI-MOTOR. Lycoming powered. Just relicensed. 79 hours since general overhaul. Radio, landing lights, flares. $3000.00 flyaway or ½ cash, balance 12 installments.

1932 CURTISS ROBIN CI. Challenger. Licensed to December, 1936. 750 hours total time. A-1, never cracked. Ideal for training. $1030.00 flyaway.

SIEMENS-HALSKE SH12 engine. 128 H. P. with Hamilton Steel propeller. Total hours run, 500—50 hours since last general overhaul. Will sell for $350.00 or trade for Warner Engine with propeller.

We can furnish materials and parts for lightplanes. Send us your specifications or blue prints and we will quote prices.

AVIATION PRODUCTS CO.

Maj. H. H. Woeltjen, Manager, Used Plane Division

619 S. Federal St. **Chicago, Ill.**

WANTED

USED AIRPLANES AND GLIDERS

We have a number of buyers who want planes of the following types. both licensed and unlicensed: Cessna Cabin J-6-7 or J-6-9, Great Lakes, Warner Fleet, Ford Trimotor and all types of light planes and gliders.

We have several unfilled orders on hand. If you have an airplane for sale, write for our Used Airplane Information Record and Sales Agreement. We will sell it at a nominal cost. We pay all sales expenses and cost of national advertising. No charge unless plane is sold.

ENGINES

Air cooled, 20 to 39 H. P., 2 or more cylinders. Cirrus or Menasco. Also OX5 and OXX6. Give price and details in first letter.

Northwest

(Continued from page 294)

sion: Bob Mensing, called the crackerjack airline blind flyer of today and Nick Mamer, famed Pacific Northwest pioneer airman. Len Ashwell stays on as Straith's co-pilot.

A light supper, a loaded and fueled Electra and the air traveler is ready to fly the final stretch of the northern transcontinental route . . . Straith and Ashwell check weather reports from mountain airways outposts closely. This stretch is the roughest, most awe-inspiring airline flight to be found anywhere in the country . . . despite daily flights over the wild country, Straith, Mensing and Mamer thrill at their coming rides. To them there is always something new and more beautiful to be found in the towering peaks and the dark, deep valleys.

Climbing steeply away from Spokane, Bill Straith sets the nose of the Electra dead on the "on course" signals of the beam. Ahead, on the horizon the newcomer to this country sees what he believes to be beautiful, high-flung clouds. To the pilots, however, this view means they must keep climbing steadily to get over the clouds which in reality are the Wenatchee and Cascade Mountains, highest in the United States.

For a short period, the airliner roars over the vast flat fields in country that is some of the most fertile in the United States . . . agriculture is very much in evidence. The Pacific Northwest's wheat center is a few minutes by air from the beacon just ahead at Harrington. To the north, approximately 100 miles, the high flying passenger can see the Huckleberry Mountains through which flow the waters of the giant Columbia river.

The steady climb of the Electra is barely noticeable to the passenger who now spends much of his time watching the surrounding magnificance. Len Ashwell comes back into the cabin to point out the Grand Coulee dam just north of the airliner's route. Below, a railroad and highway zig-zag through valleys and passes as the airliner climbs higher and higher over the foothills of the massive ranges ahead.

There to the left lies Soap Lake, a freak body of water that looks and tastes distinctly soapy. The government is building a colony on the shores of this lake for it has been discovered that its waters are beneficial for the treatment of certain diseases. Ashwell sticks his head through the cockpit door to see that Straith is keeping the ship's regular radio sequence. Straith, however, is already completing the report and is receiving Seattle's okay.

Skirting the French Hills and Saddle Mountains, Straith continues his climb as the Columbia river gorge appears, a natural spectacle that dwarfs the much-tooted Grand Canyon of the Colorado. In a few moments, the broad Columbia is passing under the ship's wings . . . a few miles up the river lies the little town of Wenatchee, famed as the center of the fertile apple country of the Northwest . . . it was at Wenatchee's airport that Hugh Herndon and Clyde Pangborn ended their trans-Pacific non-stop flight from Japan. A radio range beacon is maintained at the Wenatchee field for certain schedules on the airline include a stop at that town's well-developed airport. Straith's present schedule, however, calls for no stops until Seattle.

Flying south around the toe of the

2 OZ (6") TUBE CEMENT 6c

Yes sir, a real value, just as all Modern Supplies are. Giant values, highest quality account for leading model builders' approval of our supplies. Your order shipped one hour after received. Rush your order today to learn real satisfaction and pride.

Balsa Wood
18" lengths
1/16x1/16 ...100—5c
1/16x1/8 ... 50—5c
1/16x3/16 ... 20—5c
1/8x1/8 ... 32—5c
1/8x3/16 ... 25—5c
18" Sheets
1/16x2 ......6—8c
3/32x2 ......6—8c
1/8x2 ......4—8c
Prop Blocks
6"......6 for 5c

7"......3 for 5c
8"......3 for 5c
10" 3c
Balsa Wheels
1" 5c
1¼" 7c
3" 17c
Celluloid Wheels
¾" .....pr. 5c
1" ....pr. 7c
1¼" .....pr. 11c
Wire
2' any size 1c

Prop Hooks
Large or small
3 for 2c
Jap Tissue
White ..2 for 3c
Colored ..3 for 5c
Motor Rubber
.045 sq..20 for 5c
1/16 sq. ..20 for 5c
1/8 flat ..17 for 5c
3/16 flat ..12 for 5c
Clear Dope
2 oz. 10c
Colored Dope
2 oz. any color 10c

Send for free list
Add 8c for postage

MODERN MODELS
1846 W. 34 Place A
Chicago, Ill.

Subscribe to POPULAR AVIATION

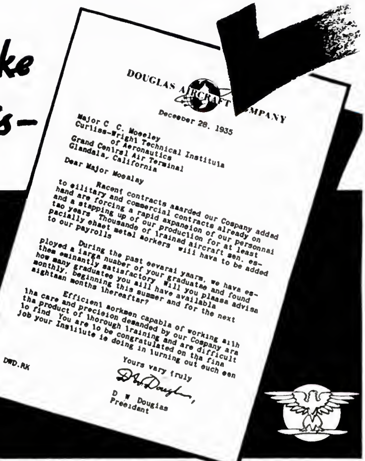
Are you going to take advantage of this—

YES, YOU CAN GET A JOB IF YOU TRAIN AT CURTISS-WRIGHT

SPECIALIZED PRACTICAL TRAINING IN AERONAUTICAL ENGINEERING AND MASTER MECHANICS. (THIS COURSE INCLUDES COMPLETE AIRCRAFT METAL TRAINING).

CURTISS-WRIGHT TECHNICAL INSTITUTE
GRAND CENTRAL AIR TERMINAL, GLENDALE, CAL.
NAME__________
ADDRESS__________
Age____
Aeronautical Engineering ☐ Master Mechanics ☐ Home Study Aero-Drafting ☐
Date I plan to enroll__________19____

Opportunity Knocks
Send the coupon today for complete information.



DOUGLAS AIRCRAFT COMPANY

December 28, 1935

Major C. C. Moseley
Curtiss-Wright Technical Institute
of Aeronautics
Grand Central Air Terminal
Glendale, California

Dear Major Moseley

Recent contracts awarded our Company added to military and commercial contracts already on hand are forcing a rapid expansion of our personnel and a stepping up of our production for at least two years. Thousands of trained aircraft men, especially sheet metal workers will have to be added to our payrolls

During the past several years, we have employed a large number of your graduates and found them eminently satisfactory. Will you please advise how many graduates you will have available monthly, beginning this summer and for the next eighteen months thereafter?

Efficient workmen capable of working with the care and precision demanded by our Company are the product of thorough training and are difficult to find. You are to be congratulated on the fine job your Institute is doing in turning out such men.

Yours very truly

D W Douglas

D W Douglas
President

DWD.RK

CURTISS-WRIGHT TECHNICAL INSTITUTE
GRAND CENTRAL AIR TERMINAL, GLENDALE, CAL.
Major C. C. MOSLEY
PRESIDENT

Wenatchee Mountains Straith, still climbing steadily, reports the passing of the radio range station at Ellensburg, which nestles down in the valley to the left. Leveling off at 11,000 feet, the plane is headed for the deep cut that lies ahead—Snoqualmie Pass. This pass is the only main artery either over or through the high Cascade range and is used by railroad, auto and airline . . . towering high on all sides of the airliner tremendous mysterious-looking peaks catch the eye . . . snow-capped Mt. Rainier is close enough to the south of the airline to touch but Ashwell assures skeptics that the famous peak is at least 60 miles away. Farther south, Mts. St. Helens and Adams can be seen in the darkening sky. Far to the north Mt. Baker sticks its snowy peak up through a surrounding cloud bank.

Tiny hamlets nestling in the wild-looking country make the city-bred person yearn for life in the "wide open spaces" . . . now, for safety's sake, there are powerful revolving airways beacons every few miles along the route through the mountains . . . radio facilities in this territory have been so perfected that blind-flying over this division is commonplace.

Twilight nears . . . scattered blizzards are raging around several snow-capped peaks . . . in the valleys, however, grass and trees are green. As the airliner tops the last and highest point on the division, one can look over the top of the steep range and down into the valley beyond in which Seattle nestles. No more snow can be seen west of the mountains . . . in spots now flowers are in bloom . . . as the Seattle airport is approached; however, many rain clouds are seen coming in from Puget Sound with the approaching darkness.

Suburban homes with their flickering lights begin to pass under the ship as it glides downward from its high perch. The descent must be gradual to prevent earaches. Through a moonlit hole in the rain squall one gets the first view of famed Puget Sound and, beyond, the Pacific.

The lights grow rapidly in brightness and numbers . . . they soon define the street lines and dense population centers . . . then comes the suggestion of the airport border lights and the traffic lights. We have arrived.

For the final time comes the click of a querying radio, the hum of lowering landing gear and wing flaps . . . lighted hangars and beacons flit speedily past the windows and Bill Straith sets her down.

It is often a source of wonder to motorist passengers how the pilot keeps his wits during this speedy descent in the dark, with lights and speeding past, but it's all in the day's work.

Is the airline pilot as overcome with his work as are his awed passengers? Not if his final report in his log book can be used as any indication . . .

"Seattle at 7:25 p. m. On time."

END.

A Safety Factor

Reduces friction, overheating, wear. Increases r.p.m. and power. Used and recommended for remarkable results by plane services and individual flyers. Write for FREE important photomicrographic and other facts. Manufactured and Guaranteed by Pyroil Company. W.V.Kidder, Pres., 332 LaFollette Ave., LaCrosse, Wisconsin, U.S.A.

$5,000.00 WORTH
A1 CEMENT AND DOPES
Must be Sold in Limited Time!

Cement
1 oz. bot. per gr. $4.50
1 pint.... .35
1 gallon... 1.60
5 gallons.. 6.50
30 gal. drum ..36.00

Clear Dope
1 oz. bot. per gr...$4.25
1 pint ..... .33
1 gallon ... 1.45
5 gallons .. 6.25

Colored Dope
Red, White, Blue, Orange, Silver, Yellow, Green, Khaki.
1 oz. bot. asst. per gr. ..$4.75
1 pint ..... .40
1 gallon ... 1.90

No orders less than $2.00 accepted. No. C.O.D.'s.
All orders F.O.B. Brooklyn.

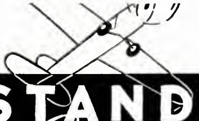
AMERICAN SALES CO.
1592 Lincoln Place (Dept. P-1) Brooklyn, N. Y.

BE A PILOT • FLY A SHIP

If you are stumped at the high cost of training to qualify for a license and a good future in aviation—write, enclosing stamp, for information on our

APPRENTICE PLAN

MECHANIX UNIVERSAL AVIATION SERVICE, Inc.
Strathmoor Sta., Dept. 82, Detroit, Mich.



"Baby Cyclone" ENGINES are BUILT TO STAND the Gaff

AIRCRAFT INDUSTRIES,
Glendale, California.

☐ Rush one guaranteed "Baby Cyclone" engine to me as described above, for which I enclose Post Office Money Order for $15.75.
☐ Send me one 13½" moulded composition propeller recommended for the "Baby Cyclone." I enclose $1.25.
☐ Send me your special 14" moulded composition propeller for 1/5 H, P. engines, for which I enclose $1.50.

Please Print Name__________
Address __________
City and State__________

Deliberately constructed of extra strong die metal with oversize parts throughout and equipped with oversize mounting lugs, the "Baby Cyclone" Engine is virtually crack-up-proof.

Light weight, too, gives this engine tremendous advantage over other equipment, as your plane will be more evenly balanced with a "Baby Cyclone" in the nose.

To these features the "Baby Cyclone" offers outstanding economy and absolute dependability which owners all over America are demonstrating right now.

We are working night and day to fill the demand for "Baby Cyclone" Engines, so do not delay in placing your order NOW.

BRIEF SPECIFICATIONS

TYPE—1/6 h.p. rotary valve 2 cycle, ¾" bore, 13/16" stroke. Variable speed from 500 to 4000 r.p.m. with 13½" prop. 1¼ oz. capacity gas tank. IGNITION—Special A-C pointed plug, 2 oz. coil, fool-proof timer. SIZE—3¼" deep x 1⅞" wide x 4¼" high. WEIGHT—Including engine, tank, coil and condenser 10½ oz. Engine shipped on wood base after actual factory run-in test. PROPELLER—Special 13½" moulded composition, $1.25. KITS—Complete, designed for this engine, now available.

$15.75 Complete, Prepaid

AIRCRAFT INDUSTRIES
Major C. C. Moseley, Pres.
GRAND CENTRAL AIR TERMINAL GLENDALE • LOS ANGELES • CALIFORNIA

Advertise in this Directory.

BUYER'S DIRECTORY

Rates: $5.00 per inch.

AIRPLANES FOR SALE

Flying costs less than driving.

WELCH FLYING CLUBS

make this possible. Through our club plan a new "WELCH" airplane can be obtained, as low as ten dollars down, and ten dollars a month each, to a club of twelve. For full details, by-laws, descriptive material, etc. Send 25 cents.

WELCH AIRPLANES
Club Dept. Anderson, Indiana.

New Aeroplanes Only $25.00

down. The famous 98 Trainer, one and two-place, beautiful midwing design, welded steel fuselage $98.00 each and up. Can be powered with Ford, Szekely, any motor weighing 250 pounds or less. Propellers $2.98 up; 40 h.p. motor $49.98; 700 Air Wheels, including hubs, $10.00 per set. Send 25c for more information and easy payment plan.

UNIVERSAL AIRCRAFT CO., FT. WORTH, TEXAS
Dept. I

AIRPLANE PARTS AND PLANS

Professional Blueprints and Factory Built Parts Cost Less

"FLEA"

Improved and Streamlined

4 large Blueprints, dimensions in feet and inches, ⅛, ¼, and ½ full size and a full size drawing of wing curve, 4 feet 6 inches long, on heavy paper. All for $2.50.
Wing curve 50c, or four blueprints, $2.00.

COMPLETE PARTS KIT

Sold in convenient groups costing from $1.50 to $8.40 each. Easily put together.

SPECIALS: Main landing gear axle, $1.50. New wheels, 24x4 straight side (less tires) $2 each. Streamline tail wheels 65 cents per pair. Welded control stick with rocker shaft and horns, $3.50. Welded rudder post and tail wheel axle, $2.50. Center section cabane struts with top plates (welded) $3.50. Stranded cable for all flying and flexible cable for control wires, $3.00. Control pulleys, 10c ea.

Illustrated Circular and Price List, 10c.

SUPERFLEA AIRCRAFT SERVICE
LAWRENCE, KANSAS

FLYING FLEA PARTS

Complete wing	$37.50
Fuselage streamlined	45.00
Welded tail-wheels, pair	3.00
Complete kit of built up parts ready to assemble	160.00

Itemized price list One Dime.
Heath & Pietenpol welded fuselages, wheels and other aircraft parts taken in trade.

KAMM AIRCRAFT CO. 524-12th St., Oshkosh, Wis.

PROPELLERS

PROPELLERS OF DISTINCTION—These laminated propellers are the most efficient made, regardless of name, make, or price. Order from this ad, cash with order.

4' for Harley and Indian motors	$ 3.50
4' 2" Heath-Henderson, metal tipped	7.65
2' Fords, Lawrence, Anzani, metal tipped	9.98
2' for OX-5, hardwood, copper tipped	16.98
MOTORS: 40 H.P. motors, rebuilt like new	49.98
SHIPS: Famous 98 Trainer, Single Piece	98.00
TIRES: 7.00-4 Air Wheels, including hubs	16.00
Information, incl. leather-bound flying manual	.25

UNIVERSAL AIRCRAFT CO., Dept. I, Ft. Worth, Tex.

BOOKS

Aviation Books

Complete Stock of Books on All Aviation Subjects.
Send for Catalog.

GOODHEART-WILLCOX
2009 So. Michigan Ave., P.A. 4, Chicago, Ill.

LIGHTPLANE DESIGN

The Fact-Book for the Home-Builder
APPROVED BY EXPERTS
Sold With a Money-Back Guarantee
WRITE FOR FREE LITERATURE
WALTER H. KORFF, Aeronautical Engineer
Box 4 - HIGHLAND PARK DETROIT, MICHIGAN

AERO BLUE BOOK

Gives specifications of over 300 airplanes, ranging from 20 to 7000 h.p. and nearly 100 aero engines. Only information of its kind ever compiled. Priceless to students, engineers, dealers and flyers. Send $1 cash, check or money order for AERO BLUE BOOK and receive FREE booklet—How to Choose a Flying School. Order now!

AIRCRAFT DISTRIBUTING CO.
Dept. 4-AO
1480 Arcade Bldg., St. Louis, Mo.
$1.00 Postpaid

INSTRUCTION

Get your start in the fast-growing

COMMERCIAL AVIATION INDUSTRY

New ocean routes soon starting. America's fastest-growing industry. Our booklet, "Wings of Commerce," lists over one hundred different occupations in this field, salaries paid, apprenticeships, promotions, how to qualify and apply. Lists all airline companies in U. S., Canada, Mexico, Central and South America. Information is complete. Price 20c postpaid.

CONTINENTAL SALES CO.
Box 344, Dept. 11 Indianapolis, Ind.

Learn Aviation at Home

Complete home study course in Aviation, including Navigation and Meteorology, offered for a limited time for only $49.75, easy terms.

AVIATION EXTENSION SCHOOL
P. O. Box 102
Prescott, Arizona.

Information pamphlets on free Government aviation training.

Army Air Corps Cadets get 300 hours solo flying, with salary, expenses paid. Information pamphlet, How to Apply, 20c. Same information on Navy Flying Training, 20c. Same on Marine Corps, 20c. Information on Army and Navy Schools for Aviation Mechanics, Aero Photographers, 20c. All four for 50c. Pamphlets prepared by Air Corps Veteran.

Continental Sales Co., Box 344, Dept. 11, Indianapolis, Ind.

MODEL AIRPLANES (Ready Built)

Ready-Built Scale Models

9 to 12 inch wing spread. High gloss lacquered finish. Much small detail included. Models are complete with walnut finished pedestal. Pine and Balsa Construction........ $1.45 P.P.

No Stamps or C.O.D.
EDW. CAVANAUGH
410 W. Susquehanna Ave.
Philadelphia, Pa.

MODEL KITS AND PLANS

GASOLINE POWERED MODEL KITS, BLUEPRINTS AND SUPPLIES

Designed by experts.
America's finest model airplane kit. Six ft. wingspan. Contains ready made ribs, finished propeller (micrometer checked), plenty of extra material etc.
Fully guaranteed.
Lists and circulars free.

ALBATROSS MODEL AIRCRAFT CO.
11-13 Hawthorne St. Hartford, Conn.

75c THREE FOOT FLYING MODEL 75c

Boys! Design, Build, and Fly your own Airplane. Send today for your kit to build a big 3 foot job. Sent Postpaid for 75c. Money Orders Only. Cash at your own risk.

AVIATION RESEARCH LABORATORY
Fillmore, Ill.

"DELUXE KITS"

12" Flying scale models of the Howard Ike, Fokker Tripe, Boeing P-26.

These kits come complete with a finished prop, turned nose block, semi-finished pants, printed balsa, strips, formed wire parts, wheels, cement, dope, tissue and accurate plans. 30c ea. p.p. No stamps.

BILL'S MODEL HANGAR
2243 N. Kilbourn Chicago, Ill.

MODEL SUPPLIES

BALSA WOOD 18"—WHOLESALE ONLY

1/32x1/16, 1000, 50c	3/32x3/32, 500, 55c	1/32x2", 100, 65c
1/16x1/16, 1000, 50c	⅛x⅛, 500, 60c	1/16x2", 100, 80c
1/16x⅛, 1000, 85c	⅛x3/16, 250, 52c	3/32x2", 50, 45c
1/16x3/16, 1000, 1.15	3/16x3/16, 250, 60c	⅛x2", 50, 60c
1/16x¼, 1000, 1.25	¼x¼, 250, 1.30	¼x2", 50, 1.00

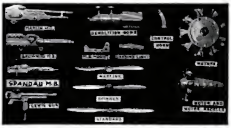
No broken lot. Order in quantity specified. Minimum order $1.00. Prices are net F.O.B. Brooklyn. We ship C.O.D. Free complete price list.

ART MODELAIRE
1313 Nostrand Ave., Brooklyn, N. Y.

ALUMINUM GEARS
METAL RIB TEMPLATES
MICROMETER SCREWS

Send 5c for list No. 42, indexes PLANS for 247 Flying Models, 47 for Gas Job

A. L. JONES CO.
P. O. Box 31 West Brighton, N. Y.



DIE-CAST MACHINE GUNS, BOMBS AND MOTORS

MACHINE GUNS
¾" long Browning..... 3c
1⅓" Browning with pin 5c
1⅝" Spandau......pair 15c
2" long Browning.......15c
2" long Marlin...........15c
1⅓" Marlin with pin...10c

LEWIS GUNS
1⅝" long...............15c
1" long..................20c

MACH. GUN MOUNT
For 2" guns..............5c
¾" Landing Light........5c

DEMOLITION BOMBS
⅝" long with pin...... 5c
1¼" long 10c
1½" long 15c

CONTROL HORNS
¼" long Set of 6.........25c
⅜" long Set of 8.........35c

DIE-CAST MOTORS
1" dia. 9 cylinder.....25c
1½" dia. 9 cylinder.....35c
2" dia. 9 cylinder.....50c
1½" dia. 2 cylinder.....25c

MOTOR NACELLE
For 1" dia. 9 cyl. motor.10c

PROPELLERS

2 BLAD.	2 BLAD.	3 BLAD.
2" ST......10c	2¼" SP......15c	1½" ST......10c
2½" ST......15c	3" SP......25c	2" ST......15c
3" ST......20c	4" SP......35c	2½" ST......15c
4" ST......25c	6" SP......50c	3" ST......25c
5" ST......30c	2" W......15c	4" ST......30c
6" ST......35c	2½" W......20c	5" ST......40c
7" ST......50c	3" W......30c	2" ST......60c
	4" W......40c	

MINIMUM ORDER 25c
No Postage

THE AIRCRAFT & MARINE MODEL CO., Dept. P.A. 4
1449 Flatbush Ave., Brooklyn, N. Y.

HURLEMAN
ARISTOCRAT
MODEL AIRPLANE MOTOR
⅝" Bore, 1" Stroke, 4500 r.p.m.
PRICE $17.50
Light weight Coils—Plugs
Send 3c Stamp for Folder
Mfg. Solely by and Obtainable Only From
WALTER HURLEMAN, INC.
1422 W. Bristol St., Phila., Pa.

PATENTS

PATENTS
PERSONAL SERVICE

Let me act as your personal confidential representative in Washington on all your patent problems.

Delays of even a few days in protecting your ideas, or the slightest carelessness in handling your patent papers, may easily be very costly. My personal service assures speedy action and strictest confidence. Send immediately for my free 72-page booklet, "How to Get Your Patent."

L. F. Randolph, 372-D Victor Bldg., Washington, D. C.

PATENT YOUR IDEAS
Send me a sketch or simple model of your invention. SATISFACTORY TERMS. *DO IT NOW!*
FREE Illustrated Literature Confidential Advice
Z. H. POLACHEK
1234 Broadway, N.Y.

Z H POLACHEK 1234 BROADWAY PATENTS NEW YORK REG PATENT ATTORNEY

PAINTINGS AND PHOTOS

--AVIATION PHOTOS--

Send stamp for revised list of commercial and military ships, or 10c for list and 5" x 7" sample.
All sizes. Enlargements.
EDWIN WORMALD
715 East 19th Street, Brooklyn, New York

MISCELLANEOUS

MIDGET ELECTRIC RADIO. Wt. only 1½ lbs. Real miniature L O U D SPEAKER built in. Size only 3½"x5½"x2½" (note picture). Easily carried in any large pocket or in traveling bag. Two Triple bi-gain tubes. Built in aerial. Tunes in all stations loud and clearly. Ideal second or personal radio. Operates on ANY 110 volt AC or DC current. Kit of parts and diagram for $6.50. COMPLETELY WIRED AND TESTED FOR ONLY $6.98. Send only $3.00 (M. O., Currency or Check) and pay postman $3.98 plus postage on arrival. Guaranteed to operate anywhere.

$6.98 Wired and Tested

TINYTONE RADIO CO. Dept. PA-4. Kearney, Nebr.

LINDBERGH STAMPS

Air Mail stamps honoring Col. Lindbergh were issued by 5 countries. Nice addition to any collection and worth holding as investment. All 6 stamps sent for $2.00. Returnable.
Ask for Price List of Air Mail Stamps.
M. J. VON DER HEYDE—HANGAR A
Roosevelt Field Mineola, N. Y.

NEW!! ALL WAVE POCKET RADIO

$2.99 complete

Fits in any pocket easily. Weighs only 4 ozs. as shown! NO tubes, batteries or electrical connection needed! Nothing to wear out or need replacement—only one moving part. Separates and receives ALL stations with beautiful clear tone by simply hooking to any metal object as desks, beds, telephones, etc. Range up to 100 miles—much greater under good conditions—very little static! Can be used by ANYONE ANYWHERE! Foolproof -- NOT a cheap CRYSTAL outfit! Absolutely *complete* with midget phone and directions to use on Bicycles, Autos, in offices, hotels, camps, at home, etc. No messy hookups! THESE ARE FACTS! Send only $1.00 and pay postman $1.99 plus postage or send $2.99 (Cash, Money order or Check). Ideal gift. Guaranteed. Order NOW! (Foreign orders 65 cents extra). At Better Dealers. Tinytone Radio Co. Dept. P.A. Kearney, Neb.

"FLYING INSTRUCTIONS — Decent Prices! Dual instruction (including radio beam and blind flying) $5.90 per hour; solo, $3.90 per hour. Every student given instruction on three different type ships, three open biplanes and one cabin monoplane. We have no put-puts or so-called lightplanes. All our ships are government licensed, modern, representative commercial types. Three hundred miles cross-country flying to every student. Learn to fly on the larger type ships and you can fly anything with wings. Living expenses $7.50 per week. Operators at the same field for thirteen years. Our aim: Prices that every student can become a licensed pilot. Automobiles, motorcycles or what have you taken in as part payment on flying time.—New Way Flying System, Bellefonte, Pa."

WANTED—Curtiss-Wright Jr. axle, located anywhere. Must be in perfect condition. Also want Szekely parts. Cash or trade.—Clyde Fowler, 513 Sonora Ave., Glendale, Calif.

COLLEGE TRAINED Bookkeeper-stenographer will exchange expert services for flying or mechanical instruction and room and board. Experienced in shorthand, typing and accounting. Will furnish my own typewriter.—Estel Davis, 635 S. Jefferson, Springfield, Missouri.

WILL EXCHANGE hard labor for living expenses and experience on airplanes and motors. Age 19; weight 135 lbs.; height 5′ 10″. Give me a chance.—Ezra Payton, C.C.C. Co. 4742, Rogue River, Oregon.

WANT young man willing to exchange services for airplane mechanical training. Must be able to finance own living expenses and books, etc. Give full details in first letter.—C. E. Doyle, 329 W. Market St., Tiffin, Ohio.

WANTED—Two 16x7-3 Airwheel assemblies with disk brakes. Whole assembly or part accepted. Cash or Trade.—G. P. PJR., 1823 Garfield Place, Hollywood, Calif.

CLASSIFIED DEPARTMENT

For cash sale advertising

RATES: 5-cents per word

FOR SALE—One gasoline powered model (Hurleman Aristocrat) Kovel-Grant 3. Lowest offer takes it.—Corwin Meyer, 1044 Williams Blvd., Springfield, Illinois.

ARMY-NAVY gives free Radio Operators' training for service on aircraft, ships. Salary, expenses paid. Information pamphlet, How to Apply, 20c.—Continental, Box 344, Dept. 11, Indianapolis, Ind.

USED AIRPLANES $50.00 AND UP—"Easy Payments." Literature 10c.—Continental Sales, Box 344. Dept. 11, Indianapolis, Ind.

PHOTOGRAPHS—Aviators, Planes, Celebrities, Scenic. All sizes. Sample and price list, 10c.—Ralston Photos, 612 No. Denny, Indianapolis, Indiana.

FILMS DEVELOPED—Any size, 25c coin, including two enlargements. CENTURY PHOTO SERVICE, Box 829, La Crosse, Wis.

AT LAST you can own a car for racing or sport use. Mine cost me one dollar. It's new in design and construction. It's a beauty on wheels. Be popular! Send five cents for illustrated information. You won't be sorry. Let me prove my statements.—Leonard Erbert, Ellis, Kansas.

A PRACTICAL COURSE in Acrobatics and Inverted Flying, fully illustrated, $1, complete. Satisfaction guaranteed. 200 Used planes, terms, OX5 jobs $75 up, complete directory, 25c Postpaid.—Aircraft Directory, Box C456, Athens, Ohio.

AIRPLANE PHOTO BARGAINS. INFORMATION FOR STAMP.—MELVIN BARRON, ROUTE 4, BOX 24, WARREN, PENNSYLVANIA.

FREE Plans for building beautiful flying Vought Corsair and solid Curtiss Hawk. Send 3c stamp for mailing.—Mercury Model Airplane Co., 1592 PA Lincoln Place, Brooklyn, N. Y.

PIETENPOL OWNERS' ATTENTION—Special set, latest type LO-EX cam ground, hardened aluminum pistons with Seal Power rings and pins. Sizes standard to .060. Money back guarantee. Complete, $15.60.—Strauss Motor Co., 818 Lincoln Ave., Toledo, O.

FOR SALE: Aircraft engines, all kinds, new and used, at bargain prices. Aircraft instruments, parts, materials of every kind. State your needs. —Aircraft Development Company, 1530 Olive Street N. E., Washington, D. C.

LIGHTPLANE BUILDERS! Your identified or experimental ship designed throughout. Blueprints furnished on completion, $25 up. Inquiries invited.—Peyton Autry, Boonville, Indiana.

FOR SALE—All designs, rights, blueprints and patterns to the Heath 4-90 motor, 70 h.p. at 2275 r.p.m. at weight of 200 lbs. 4 in line upright, aircooled motor. These motors are giving very satisfactory performance. Large number of parts included. $300.00.—HEATH AVIATION COMPANY, Benton Harbor, Mich.

BUILD the Heath Parasol this spring, $199.00. Easy to build, easy to fly. A standard airplane, not a novelty. Welded steel fuselage included. First group, $11.45. Information, 10c.—HEATH AVIATION COMPANY, Benton Harbor, Michigan.

HEATH APRIL SPECIALS. Flea motor, $20.00; 500 ft. rib stock, $3.50; propeller blanks, $2.50; aluminum false ribs, 9c; Heath special B-4 and Heath-Henderson spark plugs, 12 for $1.00.—HEATH AVIATION COMPANY, Benton Harbor, Michigan.

FREE until April First. With every order of $20.00 or more from our sale folder, we will include a 500′ package of rib stock, or a Heath glued and cut propeller blank. Folder 10c.—HEATH AVIATION COMPANY, Benton Har-Michigan.

AMERICAN FLEA—The Little Tri-Trainer. Modern design, standard control, safety upturned wing tips. Build for less than $100.00, including welded steel fuselage. 8 large blue prints, $2.95. Send 10c for more information.—Hihhs, Fort Worth, Texas.

SPECIAL 15" Propellers for Brown, Jr. and similar motors. 3 ply lamination. Price reduced from $3.50 to $1.95.—Hibhs, Fort Worth, Texas.

MODEL BLUEPRINTS! 9-ft. gas model—set, $.75. 9-ft. sailplane—set, $.50.—Peyton Autry, Boonville, Indiana.

MASTER MADE PROPELLERS. Glider motors, $3.95; Harley, $4.95; Heath, $7.50; Harlequin, $9.00; FORDS, $9.95; Velie, $15.50; OX5, $16.00. Practical course in aviation, $4.98 and an airplane FREE. The same plane, two place low wing monoplane, fly away, $6.98.—Standard Aircraft Co. of Texas. Harwood, Texas.

FLEA glider motor—Twin cylinder 6 to 10 H.P., 32 lbs., only $75.00. Cost $200.00.—Bates Aero, 4877 Armitage, Chicago.

TRADE—Cord cabriolet front wheel drive 30-31, cost $3300, 6 w.w., R.S leather upholstery, etc. Years ahead '36 cars, for 2-place dual plane. Please air mail.—J. C. Chupak, U.S.S. Richmond, San Diego, Calif.

Barter and Exchange

Notices in these columns are confined to trades. Cash sale advertising must be inserted under the Directory or Classified columns. Notices in the Barter and Exchange columns, three cents per word.

SET OX Valve seat and guide installing jig with four seat reamers. What am I offered.—Albert Voet, 3263 E. Erie Ave., Lorain, Ohio.

TRADE—Army winter flying suit for typewriter. —McFarland Aircraft Company, Greenville, Ohio.

WANTED—Heath welded fuselage, tail unit.—William Monroe, Ellenboro, W. Va.

HAVE—1908 Ford Touring Car, Evinrude Seven Horse, Caille liberty drive, and Koban outboards. Model "A" Ford motor, Trans., complete. All excellent. Want cash or what have you?—Bill O'Brien, Findlay, Ohio.

STAMP BRINGS PLAN—Bemiss Model Shop.—East Chatham, New York.

PRIMARY GLIDER, practically new, never crashed, for sale or trade. WANTED—aircooled engine, 40-55 horsepower, under 200 pounds, radial or opposed.—Bob Meyer, Pewaukee, Wisconsin.

SALE OR TRADE—Russell single place light plane. New covering. Split type landing gear. All in good shape, $45.00 less motor. Irwin 4 cylinder radial motor with Bosch mag. Perfect shape, $50.00.—Ed Parham, 636 Q St., Bedford, Ind.

SALE OR TRADE—OX ROBIN, Good Covering, New Prop. Semi Air Wheels. Motor Good. $375.00 Fly Away Macon Airport.—W. M. Barron, 431 Johnson Ave., Macon, Ga.

WANTED—Curtiss Jr. less motor or fuselage.—Russell Jones, 919 S. 18th St., New Castle, Ind.

FOR SALE OR TRADE—3 place unlicensed OX5 Swallow in extra nice condition. Covering and finish good. Motor fair. Will accept electric drill, field glasses or parachutes in trade. Price, $295.00.—Northern Oklahoma Flying Service, Blackwell, Oklahoma.

INDIAN 4 MOTORCYCLE. Excellent condition. Will trade for airplane, crackups, aircraft motors. Also STROMBERG DOWNDRAFT CARBURETER for Model A. DELTA METAL LATHE trade for what?—Lee Aircraft Company, Napoleon, Ohio.

WANTED Heath B-4, Heath-Henderson motors and Heath parts. Will trade or pay cash. Write full details and lowest cash price.—Adolphe Schlike, Box 465, Benton Harbor, Michigan.

WANT Aeronca Motor or Packmag Cross Country Twin. Have 1930 Harley "45" motorcycle. Colt's Special .22 revolver.—Lawrence Allison, 926 Lousona, Lawrence, Kansas.

WANTED—35-40 H.P. two cylinder opposed airplane engine. State condition and price in first letter. Will pay cash or trade.—Ted Kuehl, Clio, Mich.

FOR SALE OR EXCHANGE—Wall model gas motor.—Edwin Chastain, Roachdale, Indiana.

"SWAP—ELECTRIC MOTOR FOR—CASH OR WHAT HAVE YOU?—E. Kent, 143 Peter, Buffalo, N. Y.

EXCEPTIONAL 1930 DeLuxe Oldsmobile coach, with heater and 1934 R.C.A. radio, Extras easily worth $425.00. Want good licensed Curtiss Junior or OX5 Robin, preferably. Add or take cash. Exchange particulars, photos.—Earles, Hayes, South Dakota.

WANTED—OX5 biplane, Curtiss Junior or Heath, with or without motor, any condition; Heath wings, fuselages, tails, etc.; Heath-Henderson B-4, Harlequin, Lawrance, Cleone, Irwin, Anzani, Szekely, OX5 motors, any condition, also parts for same; Lawrance two-throw crankshafts; Harlequin crankcases, crankshafts, etc.; 4 cylinder magnetos; instruments; 5.00x4, 7.00x4, 14x3, 16x4, 18x3, 20x4, 26x4 wheels, tires, tubes, streamlines; steel tubing, etc. Cheap!—Earles, Hayes, South Dakota.

Learn to Fly at the
LEADING FLYING SCHOOL OF THE EAST

Special low priced course for beginners. Advanced courses offered in Blind Flying, Aerobatics, Night Flying, etc. Send for details.

SAFAIR FLYING SCHOOL
Hangar B Roosevelt Field Mineola, L. I., N. Y.
U. S. Approved Transport Pilots' School

ARE YOU INVENTIVE

OTHER MEN have read and profited by our free books, "Patent Protection," and "Selling Inventions." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send free "Evidence of Invention" form. Prompt service, reasonable fees, deferred payments, thirty-seven years experience. Avoid risk of delay. Write immediately to: Victor J. Evans & Co., Registered Patent Attorneys, 727-D, Victor Building, Washington, D. C.

New! This Amazing Addition to Model Aviation
LILLIPUT LIGHTING KIT FOR AIRPLANE & SHIP MODELS

.Note Navigation Lights

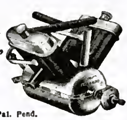
Wire up and illuminate models with real navigation lights.

Genuine Midget Electric Bulbs, only 7/32" diameter, burning on any 2 cell battery.

CONTENTS OF KIT: 3 Lilliput Pea-Lamps, 1 red, 1 green, 1 white, each with 22" specially thin flexible wire-cord; 1 miniature brass connecting-plug to fit any flashlight or electric lantern or penlite; complete instructions for installation, (or all 3 lamps white if desired for cabin or landing lights). Satisfaction Guaranteed. If Local Dealer cannot yet supply we will mail you complete Kit postpaid for.................... 85c

Dealers interested in carrying our line write:
HELIOS PRODUCTS CORP.
799 Broadway Dept. P-4 New York, N. Y.

Build an "IMP"
Reg. U. S. Pat. Off.



Pat. Pend.

TORNADO MOTOR in your next job and Enjoy the Thrill of Powered Flight!

Keep up with the newest development in model engineering by powering your models with one of these "IMP" TORNADO MOTORS. You can install it in any type model, with Motor and Generator entirely out of sight. It will swing large propellers at high speed for long, steady flights. Costs hardly anything to operate. Runs on AC:CO Gas, generated in the "IMP" Generator; a new invention that is revolutionizing model flying. Will also run on compressed air. Equally efficiant for Model Boats.

Model V-4 (shown above) four cylinder. Weight only 3⅛ oz. Will fly models from 4 to 8 feet. Complete with Generator, Feed Line and Safety Clip. $7.50

Model S-2, two cylinder. Weighs 2½ oz. Flies models 3 to 6 feet. Complete with Generator, Feed Line and Safety Clip $5.00

(If ordered by mail, add 25c for postage.)

Send 3 cents for our Latest Propeller Guide with lowest prices on genuine "IMP" Paulownia Wood Propellers. Propeller Fittings, Celluloid Dummy Motors, Balloon-tire Disc Wheels and other "IMP" Specialties, including the famous TORNADO Motors. It pays to be on our mailing list.

INTERNATIONAL MODELS CO.
1775 Broadway, General Motors Bldg., New York

Parachutes

(*Continued from page 264*)

carry quite a distance on moisture laden air which is readily absorbed by the folded and compressed silk and with disastrous results. Should oil, in some manner, get on the pack or silk it is best left until the next repacking date when the rigger can remove it with the proper chemicals. Strong solvents are never advised.

Should the 'chute be used in an emergency or otherwise and fall in bodies of water which result in a complete soaking the owner is advised to immediately suspend it full length and flush with fresh water from a hose. The material must never be wrung out but left to completely dry normally. If properly taken care of such a ducking will not harm the 'chute in any appreciable manner.

If a parachute is laid on the ground, it must be done so with the pack uppermost—never down. Under no conditions place it on end and use the pack for a seat. The wire framework, while sufficiently strong for its purpose, was never intended for use as a seat in this fashion and can readily become bent and distorted with the possible hindrance of opening qualities the result. Stepping on the pack is unnecessary but very detrimental to the location of the pilot 'chute which has been placed so meticulously.

Another common practise is the throwing of parachutes from the cockpit to the ground after flying. This too is unexcusable and never, under any conditions, should it be practised. While the equipment, itself, is relatively free of mechanical features, there are parts that can become dislodged which at the least will slow the opening process. Sufficiently hard shocks can, also, quite easily cause the pack to come open, necessitating a complete repacking.

END.

Hostess

(*Continued from page 246*)

In the matter of the occasional passenger who brings his flask along and makes himself objectionable, the hostess has an ace up her neat uniform sleeve. If he won't listen to reason, she calls the pilot. And in the air, the senior pilot is head man. His instructions are obeyed, or else!

Lunch time arrives, and the hostess turns waitress. She washes her hands, and she opens the lunch boxes according to detailed rules. Do you know what happens if you suddenly pull the cork out of a thermos bottle at a high altitude? Try it once and you won't do it again—especially if the bottle is full of hot coffee.

The hostess knows that the pressure inside a thermos or other air-tight container is greater at high altitudes, so she eases the cork out carefully.

She serves the lunches, cleans up and washes the silver—and don't try to get away with a spoon as a souvenir of your trip, for the hostess has instructions to cover that unlikely happening.

If the plane is making a stop about meal time, she tells the passengers in advance whether they will have to get lunch during the stop or whether lunch will be served aloft when the trip is resumed.

The TWA hostess must know enough about planes and flying to answer ordinary questions, but if a passenger wants teachnical details she tells the co-pilot who stops on his next trip back through the plane—he makes them at regular intervals and so does the senior pilot—and obliges with information.

On night flights, the hostess guards the peace and quiet of sleeping passengers. She talks as little as possible, and in a low voice. She tactfully reminds loud-talking passengers that they are probably disturbing others.

END.

WHOLESALE PRICE LIST NO ORDERS ACCEPTED FOR LESS THAN 2.50
All Orders Sent Express Charges Collect No C. O. D.'s, No Stamps. Send for Complete Price List.

FREE 1/2 PINT CLEAR CEMENT WITH EVERY ORDER FREE

BALSA
36" LENGTHS
PER 100
1/32x1/16 ....10c
1/16x1/16 ....10c
1/16x3/32 ....18c
1/16x1/8 ....19c
1/16x3/16 ....24c
1/16x1/4 ....26c
1/16x1/2 ....60c
3/32x3/32 ....24c
1/8x1/8 ....29c
1/8x3/16 ....48c
1/8x1/4 ....52c
3/16x3/16 ....65c
1/4x1/4 ....80c
1/4x1/2 ....$1.50
1/2x1/2 .... 2.15
1x1 ea. 6c 1x1½ ea. 11c
½x2 ea. 8c 1x2 ea. 13c
2x2 ea. 23c 2x3 ea. 32c
36" SHEETS
1/64x2 ....10 for 16c
1/32x2 ....10 for 14c
1/16x2 ....10 for 17c
3/32x2 ....10 for 20c
1/8x2 .....10 for 22c
3/16x2 ....10 for 31c
1/4x2 .....10 for 40c
SHEETS 3" WIDE
Double these prices.
PROP. BLOCKS
PER DOZEN
½x¾x5 .5c ½x¾x6 .5c
⅝x1x7 14c ⅝x1x8 17c
¾x1¼x10 ....29c
¾x1¼x12 ....34c
1x1½x12 ....38c
1x1½x15 ....52c
WIRE, PER 100 FT.
No. 6 .20c No. 8 .23c

No. 10 .25c No. 12 .30c
No. 14............35c
HIGH GLOSS DOPE
2 oz. bot., doz. .$1.25
BALSA BALLOON WHEELS
½" dz. 9c ¾" dz. 11c
1" dz. 14c 1¼" dz. 19c
1⅞" dz. 35c 3" dz. 75c
BIRCH WHEELS
LIGHT and STRONG
½" dz. .5c ¾" dz. .6c
1" dz. .8c 1¼" dz. 10c
1⅞" ....dz. 15c
NOSE BLOCKS, PER DOZ.
1x2x1 ..6c 2x2x1 .12c
3x3x1 .20c 3x3x2 .39c
REED
1/32 dia. ..50 ft. 15c
1/16 dia. ..50 ft. 18c
3/32 dia. ..50 ft. 20c
DOWELS
1/16x6" ....Gross 40c
1/8x36" 100 for $1.50
RUBBER THREAD
BEST QUALITY FRESH
.045 sq. 225 skeins 36c
1/16 sq. 225 skeins 40c

1/8 flat 225 skeins 45c
Per POUND,
1/16 or 1/8.....$1.05
SANDPAPER
12 pkgs. 25c
INSIGNIAS—24 AND STRIPES
1 Sheet..5c Doz...36c
50 ...$1.25 100 .$1.75
1000 Sheets ...$15.00
BEST BAMBOO
1/16x1/4x15 doz...8c
1/16x1/16x12 gross 15c
WOOD VEN. PAPER
20x30 ....each 7c
½" NOSE PLUGS, HARDWOOD
1 doz...5c 100 ...40c
1000 ....$3.50
THINNER
1 oz. dz. 44c 2 oz. dz. 75c
½ pt...25c 1 pt...40c
1 quart...........65c
½ gal. 90c 1 gal. $1.50
PROP. SHAFTS
1 gross 45c
CLEAR CEMENT.
DRIES QUICKLY.
BEST QUALITY
1 oz. bottle ..doz. 45c

2 oz. bottle ..doz 80c
2 oz. tubes. doz. $1.00
½ pint 30c 1 pint 45c
1 qt. 75c ½ gal. $1.25
1 gal. $1.75 5 gal. $7.50
CLEAR DOPE
1 oz. bottle ..doz. 44c
2 oz. bottle ..doz. 80c
½ pt...25c 1 pt...40c
1 qt..65c ½ gal..90c
1 gal. ....each, $1.50
COLORED DOPE
Red, White, Blue, Black, Orange, Silver, Yellow, Olive Drab, Cream, Gray, Khaki.
1 oz. bottle..doz. 50c
2 oz. bottle..doz. 90c
½ pt. .35c 1 pt. .50c
1 qt. 85c ½ gal. $1.35
1 gal. $2.23
TISSUE "AA" 20x24
1 doz. white......11c
1 doz. colored....14c
SILVER TISSUE
20x24....per doz. 21c
WASHERS, PER 100
⅛ O.D. 5c ¼ O.D. 5c
BRASS EYELETS
1/16 I. D., 100...15c

RELIABLE DEALERS SUPPLY
416 Gravesend Ave., BROOKLYN, N. Y.

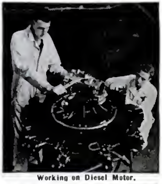
SHEET ALUMINUM
12" WIDE
.003 .....5 ft. for 50c
.010 .....5 ft. for 75c
.0003 thick 3½ wide..25 ft. for 12c
ALUM. TUBING
1/16 ....5 ft. 30c
⅛ ....5 ft. 32c
MODEL PINS
½" or 1".12 pkgs. 35c
MACHINE CUT PROPS, per dozen
5" .22c 6" .25c 7" .33c
8" .38c 10" .48c 12" .58c
THREE-VIEW
20" FLYING PLANS
Goshawk, Fokker D VII, Boeing 247, S. E. 5, S-P-A-D, Vought Corsair, Gee-Bee, Douglas Amph., Waco Cabin, Boeing P12F., Sparrow Hawk.
10c each
12 assorted 75c
50 assorted ...$2.50
100 assorted ... 4.50
THRUST BEARINGS, per dozen
Small...8c Large.10c
CELLULOID WHEELS, per dozen
¾" 24c 1" 25c 1¼" 35c
1⅞" ..60c 3" ..$1.50
SHEET CELLULOID
12½x16 ....each 15c
8x8 ....doz. 45c
½" to 1" Celluloid Pants ...doz. $0.80
1⅛" to 1⅞" Celluloid Pants. doz. $1.00

Train at LINCOLN★ to Earn More Money in AVIATION

$100,000 Lindbergh Airport covering 160 acres of level land adds to the completeness of Lincoln's training facilities.

★ There is big-pay success ahead in Aviation but you must have complete, specialized training to qualify for these high salary jobs. Aviation executives who pay $200 to $500 a month for Pilots and Mechanics demand men with thorough, expert training . . . the kind of Approved training LINCOLN offers you. Training at this "World's Best Known Aviation School" is thorough from every standpoint!

Learn All Types of Flying at Lincoln.



Working on Diesel Motor.

Fly Many Different Types of Modern Planes.

Government Approved School with Complete Training for Government Pilot's License or Government Mechanic's License

Whether you want to be Transport, Limited Commercial, Private or Amateur Pilot, Lincoln Flying School training includes everything to make you a first class one—and to qualify you for your Government Pilot's License. You learn straight flying, night flying, blind flying by instrument, radio beam flying, cross country flying, acrobatics, spot landing, aerial navigation—everything to meet government requirements, and more.

Individual Instruction Methods

assure rapid and more thorough progress. Factory methods, combined with shop and laboratory practice, make learning easy and thorough. Our instructors and executives give their entire attention to your aeronautical education. For a quarter of a century Lincoln has sent excellently trained men out into the world to win rich rewards. Now in **26th year; 16 years teaching aviation.** Many graduates employed by the industry's best known airlines and factories.

Lincoln Approved Mechanics School training is all-complete, giving you every requirement for Government License as Airplane and Engine Mechanic—qualifying you for the good-pay jobs with factories and airlines. You rebuild Whirlwinds, Wasps, Cyclones, Aircraft Diesel and many other aircraft engines. You rebuild modern airplanes under factory standards. Training also includes aerial radio, welding, instrument repair, etc. Machine shop practice.

Approved Modern Equipment

We use only planes which are inspected and approved by the U. S. Department of Commerce. You learn to fly open cockpit biplanes, low wing and high wing monoplanes, small and large transport types of cabin planes for complete experience. Both flight and mechanics schools and facilities are among the finest in America. Both under Government Supervision. High class instructors. Thoroughly equipped buildings. Lincoln stands on its own merits as a school—not a branch of any other industry. Every facility is directed toward furthering your aeronautical progress.

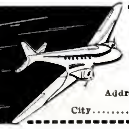
The Best Time to Start Is NOW—The men training at Lincoln now are getting ready for the many big-pay jobs which tremendous aviation development programs are creating. Now is the time to join this happy, ambitious group of young men.

Part-Time Employment

This Spring we can offer a limited number of ambitious men part-time employment to cover cost of board and room while training. Hurry! Now is the time to start at Lincoln for a successful aviation career. Write now for complete information.

Lincoln Airplane & Flying School 238-F Aircraft Bldg.
Lincoln, Nebraska

Mail This Coupon Now!



LINCOLN AIRPLANE & FLYING SCHOOL
238-F Aircraft Bldg., Lincoln, Nebraska

YES! I want further facts about LINCOLN'S complete training and the big-pay opportunities ahead in Aviation.

Name..

Address.. Age.............

City.. State..............................

WILL PREPARE YOU TO PASS ANY LICENSE TEST

Aeronautics: A Ground School Text Book

by Hilton F. Lusk, Transport Pilot; formerly Dean, Boeing School of Aeronautics. 175 illustrations. **$3.25**

This is a complete ground school course in handy book form. It clearly and thoroughly explains all the subjects you need to understand to pass the written part of the government examinations for a license as an airplane pilot in any of the grades—including transport pilot, or as an airplane or engine mechanic. No one who masters this book need fear any difficulty in answering any question that may be asked in the government examinations. So clearly and simply written that you will have no difficulty in grasping its explanations, even if you must study at home without the aid of an instructor. 224 questions like those asked in the official examinations help you test your understanding of each subject.

CONDENSED OUTLINE. **Principles of Flight:** Explains all the essential aerodynamic factors and their application to airfoils. **Airplane Construction and Operation:** Principles of construction and materials employed. Methods for working wood and fabric. Welding metal planes and parts. **Flying.** Elementary acrobatics. **Propellers:** Theory, Construction and maintenance of wood and metal propellers. Variable pitch propellers. **Engine Construction and Operation:** Theory. How to determine engine efficiency. Types of engines, construction materials. Fuel systems, carburetors, ignition systems. Engine operation and maintenance. **Blind Flying Instruments:** Use of attitude instruments in blind flying. Absolute and relative references. Inclinometers. Pitch, roll, turn indicators. Operating principles of gyroscopic instruments. **Engine Instruments:** Construction and operation of tachometers, pressure gages, thermometers, fuel quantity gages. **Safety Appliances:** Parachutes; Aircraft radio, antenna details, shielding methods, etc.; radio range beacons and markers. **Aviation Maps and Piloting:** Explains and illustrates various map projections and their use in avigation. Practical hints on piloting. **Dead Reckoning:** Details of methods with solutions of practical problems. **Avigation Instruments and Equipment:** Describes and illustrates each of the avigation instruments found in aircraft and explains theory so you can understand principles on which it operates. **Principles and Applications of Meteorology:** Effects of winds, storms, visibility in relation to flight.

A COMPLETE ENGINE COURSE IN HANDY BOOK FORM

Aircraft Engine Mechanics Manual

by C. J. Moors, Chief Instructor, Dept. of Mechanics, Air Corps Technical School, U. S. Army, 189 illustrations. **$4.50**

This book covers the same ground as the course given the enlisted mechanics of the Army Air Corps with the addition of much data on types of equipment suited only to commercial airplanes. It deals thoroughly with all kinds of aircraft engines and their accessories. It explains exactly how they operate and the features in which the various makes of competing equipment resemble each other and those in which they differ.

Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments. Particularly important is the detailed information on locating causes of engine troubles. The book is lavishly illustrated; photographs, diagrams, and working drawings make it easy for you to follow each explanation. 400 questions enable you to test your understanding of each subject treated.

Among the engines dealt with are: Pratt & Whitney Wasp, Wasp Junior, Hornet; Wright Whirlwind, Cyclone; Curtis D-12, Conqueror, Challenger; Lycoming; Packard-Diesel; Warner-Scarab; Kinner; LeBlond; Continental; Liberty. **Equipment covered includes:** Scintilla Magnetos, Types AG and V-AG, Double Magneto Type SC, N Series; Eclipse and Leece-Neville Electric Generating Systems; Delco Battery-Generator. Ignition System; Eclipse Engine Starters; Zenith and Stromberg Carburetors; Superchargers; Cooling and Lubricating Systems, etc., etc.

(Fill in, tear out, and mail)

Sent on 5 Days' Approval

The Ronald Press Company
Dept. M119, 15 East 26th St., New York

Send me the books checked below with the privilege of examination before purchase. Within five days after books are received I will return any that are not satisfactory and remit for those I keep at the prices shown plus a few cents for delivery. (We pay delivery on orders accompanied by cash; same approval privilege.)

☐ **Lusk,** Aeronautics	$3.25
☐ **Moors,** Engine Manual	4.50
☐ **Hartz-Hall,** Rigging Handbook	3.50
☐ **Eddy,** Aircraft Radio	3.00
☐ **Ramsey,** Navigation	4.50
☐ **Klemin,** Stress Analysis	5.00
☐ **Clark,** Elements of Aviation	3.00
☐ **Diehl,** Engineering Aerodynamics	7.00

Name ....

Home Address ....

City .... State* ....

☐ Employed by,
☐ or Reference ....
(Must be filled in unless you send cash)

Address ....

***If outside continental U. S. and Canada, send cash plus 25c per book for shipping.**

INTRODUCTION TO AIRPLANE DESIGN:

Elements of Aviation

by Colonel V. E. Clark, *formerly Chief Aeronautical Engineer, U. S. Army. 24 illustrations.* **$3.00.**

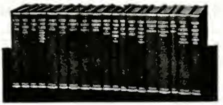
A simple explanation of the principles of flight and of elementary airplane design, telling just what an airplane does and why it does it. The book covers the fundamentals of aerodynamics by simple, easily understood comparisons; laws of motion and their application in aeronautics; air forces; lift and drag; airflow over various surfaces; effects of airflow; stability and control; propeller effects; slipstream, etc.; effects of altitude; parts of an airplane; weights and dimensions, etc.

USED BY FAMOUS DESIGNERS:

Engineering Aerodynamics

by Lieut. Cmdr. Walter S. Diehl, *(C. C.) U. S. Navy, Scientific Section, Bureau of Aeronautics. 159 illustrations.* **$7.00.**

In this book America's outstanding authority covers modern hydrodynamic theory and its practical applications, including stream function, velocity potential, circulation vortex theory, induction theory, etc. Test data on standard wing sections, ailerons, streamlining, etc., are included with working diagrams and equations, and detailed instructions for their use. Shows how to interpret model test data, gives methods for designing control surfaces, and for rapid performance estimation.



Your Satisfaction Guaranteed
Examine Them—Then Decide

You can order any of the books described on this page with the privilege of examination before purchase. Payment is not due until five days after they are delivered; you can return them within that period if you are not satisfied in every respect.

ESSENTIAL FOR SAFE FLIGHT:

Airplane Mechanics Rigging Handbook

by R. S. Hartz, *formerly Lieut. Colonel, Air Corps, U. S. Army;* **and Lieut. E. E. Hall,** *formerly Editor, "Aircraft Servicing."* 104 *illustrations.* **$3.50.**

This book covers in detail the care and handling of airplanes on the ground and in the shop; sequence of rigging steps; how to true up the assembled ship; how to adjust the wings and control surfaces for "hands off" flying; spars and struts; inspection; installing and checking compasses; fabric; wood and glue; metal parts; wire; dopes and doping; folding and packing parachutes. It shows you how to get a plane into proper flying condition and how to keep it that way.

EVERY AIRMAN NEEDS THIS BOOK:

Aircraft Radio

by Lieut. Myron F. Eddy, *U. S. Navy, Retired. 68 illustrations.* **$3.00.**

The only complete guide to the principles, equipment, installation, operation, and maintenance of aircraft radio. Tells how it is used in aerial navigation, with complete details about apparatus, radio beacons, instrument-board visual indicators, etc.; how weather data and flight orders and reports are exchanged between airplanes and ground stations; how radio sets are installed in planes, and how the plane is electrically bonded and shielded to eliminate interference; how to service radio sets; full details of specific circuits, etc.

A PRACTICAL GUIDE FOR PILOTS:

Navigation of Aircraft

by Lieut. Logan C. Ramsey, *U. S. Navy; Instructor in Aerial Navigation, Pensacola Naval Air Station. 51 illustrations.* **$4.50.**

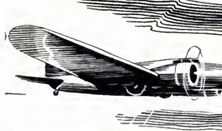
Covers the practical, everyday sort of navigation every pilot must know. Emphasizes dead reckoning, including plotting, course setting, determining and correcting for wind effects, etc. Piloting and navigation by aerial astronomy are also fully explained. In addition to its major presentation of the principles and practice of position finding by calculation and observation, the manual covers fully maps, instruments, and accessories; compasses; navigational practice, etc.

HOW TO CALCULATE STRESSES:

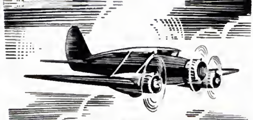
Airplane Stress Analysis

by Alexander Klemin, *Director, Daniel Guggenheim School of Aeronautics, New York University. 105 illustrations.* **$5.00.**

How to make the calculations in the stress analysis required by the Department of Commerce. Each point is explained with the utmost clearness; advanced mathematics has been avoided as far as possible. Explains principles of applied mechanics involved. Takes as an illustration an average airplane and gives full examples of all computations required. Includes tables giving vast amount of stress data, covering steel, wood, tubing, hard wire, steel cable, tie-rods, rivets, bolts, etc.



BOEING



STINSON

DOUGLAS

AIRLINES
and Their Insignia

THE ability to identify the various commercial transport planes flying overhead is not only an interesting and educational recreation but is also frequently very useful. All of our readers will, therefore, be intrigued by the commercial airline insignia shown on the back cover. With 1935 behind us, the greatest year yet in air transportation history, it is time to pause a moment for a brief survey of the airlines; to note who and what they are.

AMERICAN AIRLINES, INC.

American Airlines' transcontinental route, called the Southern Transcontinental Route, stretches from New York through Washington, Memphis, Dallas, El Paso and Phoenix to Los Angeles. Condor sleeper planes are flown by night and Douglas DC-2's by day. American Airlines also operates from New York to Chicago via Buffalo and Detroit with Douglas equipment and from Chicago to Dallas with Vultees.

There is also a Douglas run from Washington to Chicago via Cincinnati and Indianapolis. American Airlines will soon have the new Douglas DST sleeper plane carrying 16 passengers and a similar ship for day flying carrying 24 passengers. The executive offices of this airline are located at Chicago.

NORTHWEST AIRLINES, INC.

From Chicago, the airway of Northwest Airlines passes through St. Paul and Minneapolis, Fargo, Billings, Spokane and Seattle. There is a north branch from Fargo to Winnipeg, Canada. A fleet of Lockheed Electras are used over the entire route with the exception of the north branch and a Hamilton is used on this run. Northwest Airlines makes St. Paul its headquarters.

EASTERN AIR LINES

This line makes its headquarters in New York where Eddie Rickenbacker presides as General Manager. Douglas DC-2's fly its routes from New York to Miami and New York to New Orleans via Atlanta. Douglas and Lockheed Electra planes are used on the Chicago-Atlanta-Miami run.

BRANIFF AIRWAYS, INC.

Braniff Airways is the major north-south airline in the central west; the only one connecting with Pan American Airways at Brownsville for Mexico, Central and South America. A fleet of speedy and trim Lockheed Electras operates on the "Great Lakes to the Gulf" route from Chicago to Kansas City, Oklahoma City, Tulsa, Ft. Worth, Dallas, San Antonio, Corpus Christi and Brownsville. Braniff also operates from Amarillo to Houston via Dallas. A few Lockheed Vegas are still in use on non-passenger flights. Oklahoma City is the site of headquarters.

BOWEN AIR LINES, INC.

With headquarters at Ft. Worth, Bowen Air Lines operates a feeder route from Dallas-Ft. Worth to Houston and Dallas-Ft. Worth to San Antonio. Vultees are used on all schedules.

TRANSCONTINENTAL & WESTERN AIR, INC.

TWA operates the shortest route from New York to Los Angeles via Pittsburgh, St. Louis, Kansas City and Albuquerque. There is a loop north from their mail route from Pittsburgh to Chicago to Kansas City to tap the great flow of traffic from the air transport center of the country—Chicago. TWA is equipped with 26 Douglas DC-2's, the largest number of these planes owned by any airline in the world.

CANADIAN AIRWAYS, LTD.

Our neighbors to the north are building an important airline in Canadian Airways, Ltd., with offices at Winnipeg. Most of the flying done now is charter work, though several large portions of the proposed system are operating as scheduled mail routes, offering the only communication, except radio, with many portions of the country in winter. They have accomplished much in the way of exploration and, when the system is completed, it will link the Atlantic and Pacific oceans and the far northern outposts to the southern metropolitan areas. Their equipment includes D. H. Dragons, Fairchilds, several small flying-boats and some Bellancas.

WILMINGTON-CATALINA AIRLINE LTD.

This airline flies Douglas Dolphin amphibian planes from Los Angeles (Wilmington) to Catalina Island. It is owned by P. K. Wrigley and the general offices are at Avalon, Catalina Island. The traffic is made up mostly of tourists and residents of Catalina Island.

UNITED AIR LINES TRANSPORT CORPORATION

United Air Lines' transcontinental route is aptly named the Mid-Continent Route, since it splits the country from New York to San Francisco via Cleveland, Chicago, Omaha and Salt Lake City. From Salt Lake City, a branch runs up to Portland and Seattle. Then they cover the entire West Coast from Seattle to San Diego, connecting all important Pacific Coast cities. The line is equipped with Boeing 247-D's over its entire system. The general offices are in Chicago. United Air Line's insignia is probably the best known in the country.

WESTERN AIR EXPRESS CORPORATION

Western Air Express also operates Boeing 247's from San Diego to Los Angeles to Salt Lake City. Their insignia, an Indian head on a flying arrow, is one of the best known insignias in the west. Headquarters are at the Union Air Terminal, Burbank, California.

CENTRAL AIRLINES, INC.

This airline flies Stinson Model "A" tri-motor planes from Washington to Pittsburgh, Akron, Cleveland and Detroit. Its route parallels that of Pennsylvania Airlines. The General Offices are at Pittsburgh.

NATIONAL PARKS AIRWAYS, INC.

National Parks Airways bases at Salt Lake City and operates Boeing 247's from Salt Lake City up to Great Falls, Mont. During the summer months, regular stops are made at West Yellowstone, thus bringing one of the greatest vacation grounds in the country directly within reach of air travelers.

PENNSYLVANIA AIRLINES AND TRANSPORT COMPANY

Pennsylvania Airlines flies Boeing 247's on the Washington Detroit division of their airways, and Tri-motor Fords with flotation gear on the Detroit-Milwaukee division, which operates across Lake Michigan. Its headquarters is at Pittsburgh.

PAN AMERICAN AIRWAYS SYSTEM

The great Pan American Airways System flings its fast growing lines around South America, through Central America, Mexico, Alaska and China, and soon passengers will be flying on the Trans-Pacific Route. A new line is being engineered through the South Pacific to Australia.

All subsidiary lines to Pan American use the same insignia as the mother line. These are Aerovias Centrales, Cia Nacional Cubana de Aviacion, Pacific Alaska Airways, Scadta and China National Aviation Corporation. The only variation occurs in the insignia used on the West Coast of South America. Here Pan American operates as the Pan American-Grace Airways. Ships flying this portion of the route have the word "Grace" painted on the wings of the insignia.

HANFORD AIRLINES, INC.

Hanford Airlines flies Fords and Lockheed Vegas from St. Paul and Minneapolis to Omaha and Kansas City. One arm of their route extends up from Sioux Falls to Bismarck. Sioux City is Hanford's home office.

CHICAGO AND SOUTHERN AIR LINES

The Chicago-New Orleans route is operated by Chicago and Southern Air Lines. This line was formerly Pacific Seaboard Air Lines and operated on the West Coast, but received the mail contract on their present route in 1934. The company now operates a fleet of Stinson tri-motor Model T planes through the Mississippi Valley via St. Louis, Memphis and Jackson, with general offices at St. Louis. Within a short time the line will be equipped with Lockheed Electras.

DELTA AIR LINES

Delta Air Lines has a strategic route from Charleston, S. C., through Atlanta to Dallas. It is operating Lockheed Electras on the Dallas-Atlanta division and Stinson Model A tri-motor planes on the Atlanta-Charleston division. Headquarters is at Monroe, La. This air line is a good example of the feeder air line, crossing Eastern Air Lines, Chicago and Southern Air Lines, Braniff Airways and American Airlines.

WYOMING AIR SERVICE, INC.

Wyoming Air Service runs from Billings, Mont., to Cheyenne, Denver and Pueblo. Boeing 247's are flown on the Cheyenne-Denver schedules and Boeing Monomails, Stinson Reliants and Lockheed Orions on the other runs. Casper, Wyoming, is its headquarters.

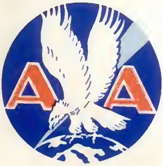
LOCKHEED

VULTEE

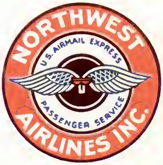
MARTIN

AIRLINE INSIGNIA

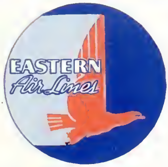
POPULAR AVIATION . . . APRIL 1936



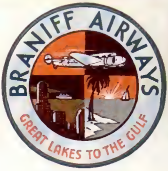
American Airlines, Inc.



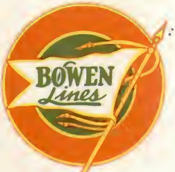
Northwest Airlines, Inc.



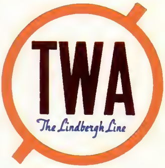
Eastern Air Lines


BRANIFF AIRWAYS
GREAT LAKES TO THE GULF

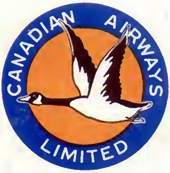
Braniff Airways, Inc.



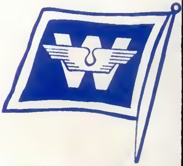
Bowen Air Lines



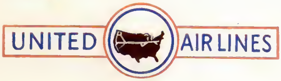
Transcontinental & Western Air, Inc.



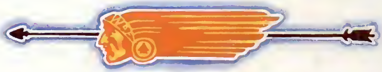
Canadian Airways, Ltd.



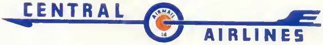
Wilmington-Catalina Airline, Ltd.



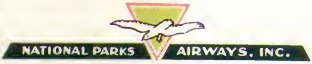
United Air Lines



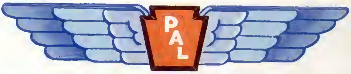
Western Air Express Corporation



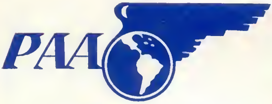
Central Airlines, Inc.



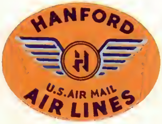
National Parks Airways, Inc.



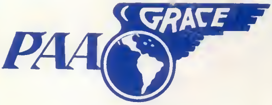
Pennsylvania Airlines and Transport Co.



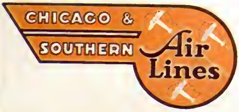
Pan American Airways, Inc.



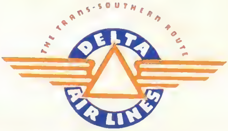
Hanford Airlines, Inc.



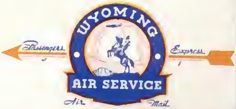
Pan American-Grace Airways



Chicago and Southern Air Lines



Delta Air Lines



Wyoming Air Service, Inc.